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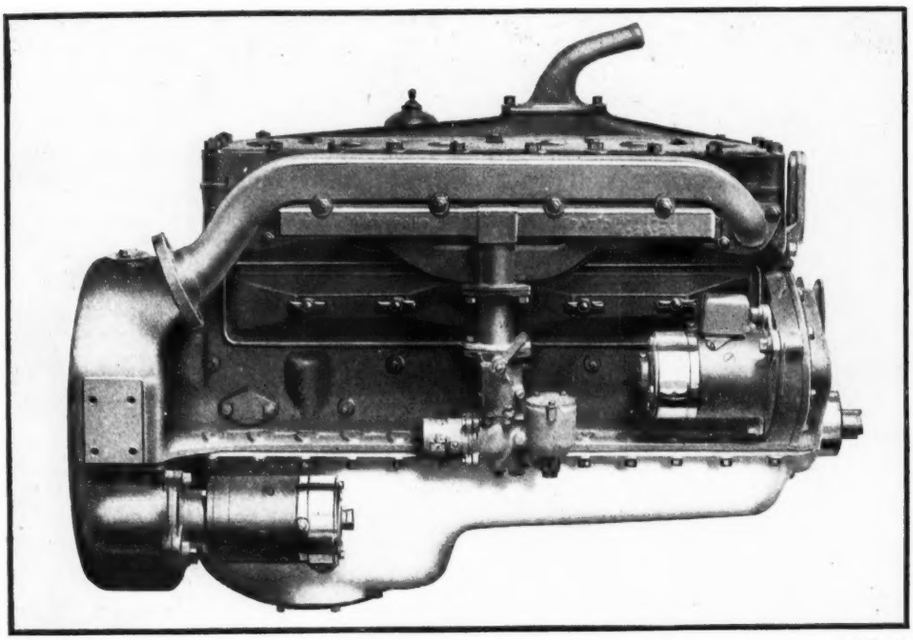

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AUTOMOTIVE INDUSTRIES
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Production Progress —a Glimpse into Future Possibilities

By JOHN YOUNGER

WHERE stands automotive production progress today? How can it be gaged?

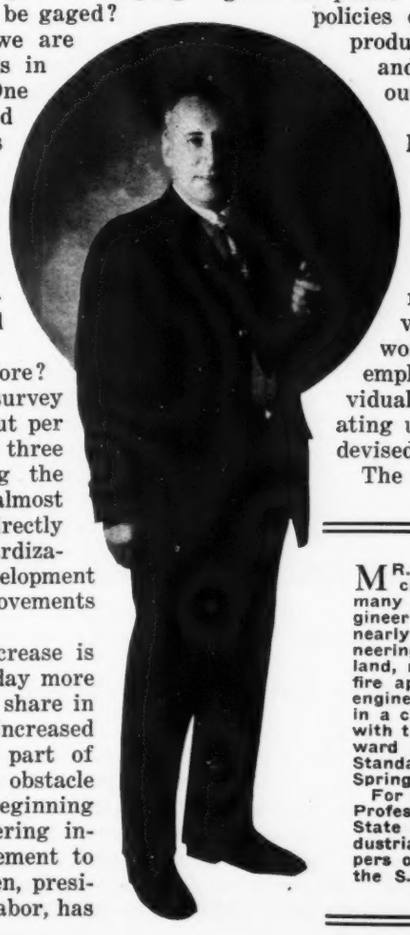
Measured by volume we are producing at new records in tremendous quantities. One new vehicle is produced about every two seconds and the pace is continuing unabated.

Volume is not, however, the true standard of progress. Volume must be produced economically with a steady trend toward further elimination of wastes, and it is this phase of the subject which offers a tremendous field for the investigator.

Do men produce more today than before?

L. P. Alford made a statistical survey which revealed that in 1925 the output per man in the automotive industry was three times what it was in 1914 during the halcyon days before the war. This almost unbelievable increase can be traced directly to the impulses given by (1) standardization, (2) waste elimination, (3) development of specialized machines, and (4) improvements in management methods.

What is important is that this increase is still going on. Working personnel today more than ever before is realizing that its share in the wealth of the country can be increased by an increased production on the part of every worker. Trade unions, long an obstacle in the path of productivity, are now beginning to see the light and in some pioneering instances are cooperating with management to secure labor economies. William Green, president of the American Federation of Labor, has gone on public record as welcoming many modern policies of management, such as time study, production control, and work planning and routing, as incentives to increased output and increased wages per man.

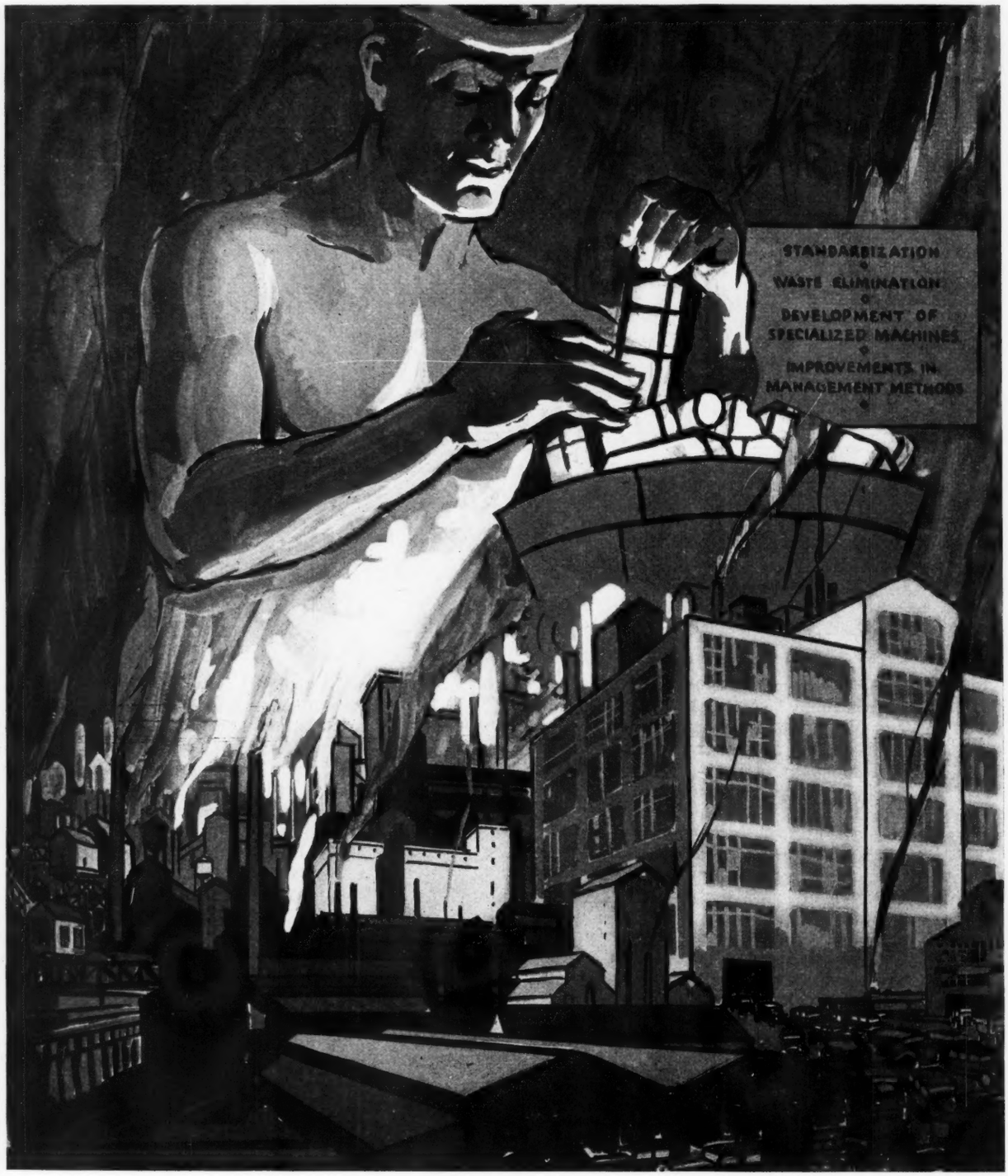


True, the automobile industry has had comparatively few union problems, but the above is cited as an instance of industrial trends in general which have influenced non-union as well as union men.

High wages are fast becoming the rule. New wage payment methods involving greater incentives for greater work are being studied. The automotive employee is no longer working as an individual but as an integral part of a cooperating unit. Wage payment policies must be devised to meet the changing situation. The gang rate system developed some

MR. YOUNGER has been intimately associated with the automotive industry for many years. Prior to becoming chief truck engineer of the Pierce-Arrow Motor Car Co., nearly 15 years ago, he was engaged in engineering work for Dennis Bros., Ltd., of England, manufacturer of motor trucks, buses and fire apparatus. During the war he was chief engineer of the Motor Transport Corps, acting in a civilian capacity, and later was associated with the Standard Steel Car Co. He was afterward in charge of engineering work for The Standard Parts Co., which became the Eaton Spring & Axle Co.

For the past few years Mr. Younger has been Professor of Industrial Engineering at Ohio State University. He is a close student of industrial trends and has contributed many papers on engineering and industrial subjects to the S.A.E. and other engineering societies.

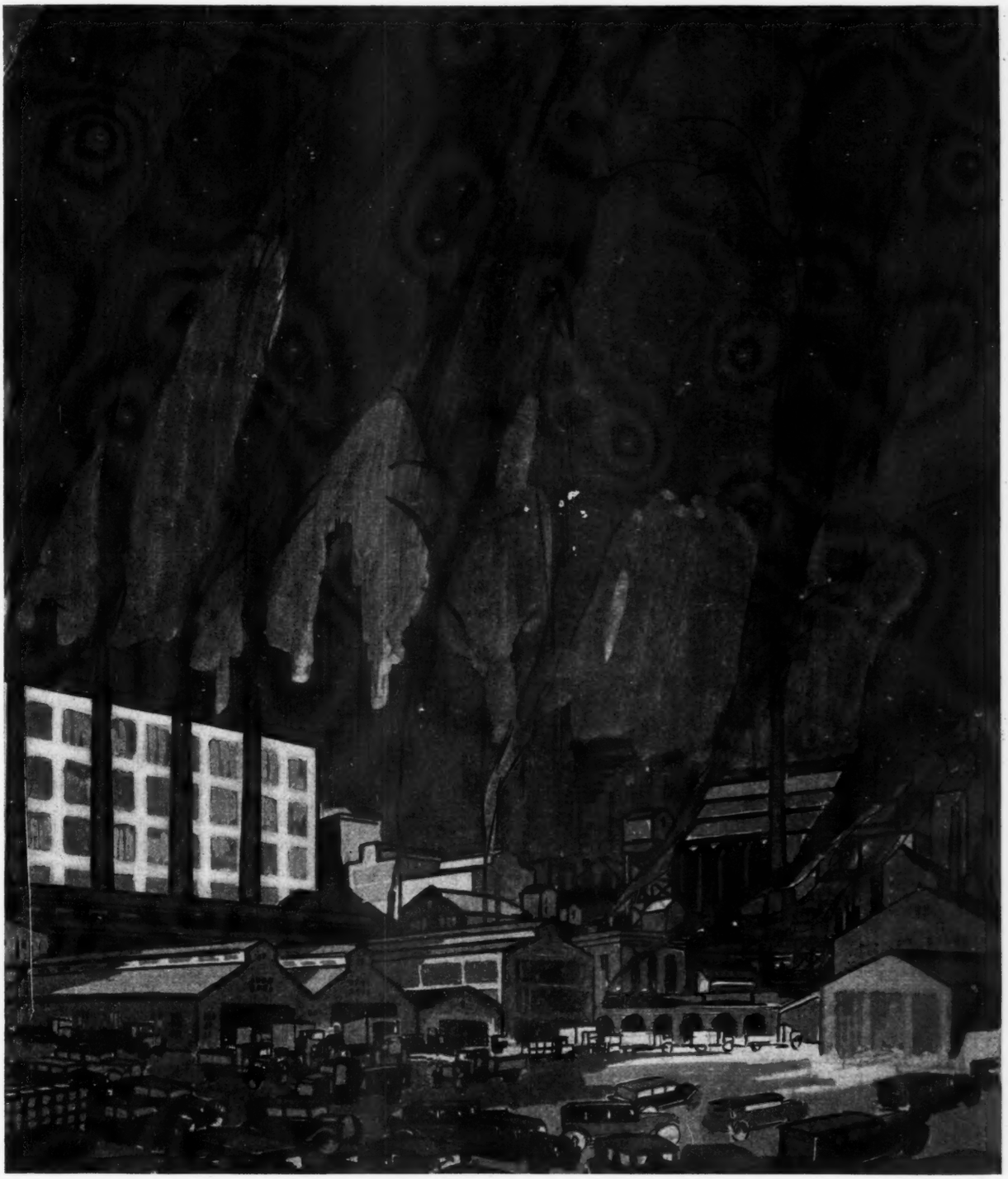


In 1925 the output per man in the automotive industry was three times what it was in 1914. This (2) Waste Elimination, (3) Development of Specialized Machines, and (4)Improvements

years ago by Carl Wennerlund of General Motors Corp. or some variation of this or other types of incentive systems are being adopted more and more in our mass production industries and are leading to greater economies in unit costs.

There are naturally two sides to this wage payment question. Some authorities are asking why men should be paid additional bonuses when the pace of their work is set by mechanical means, urging that a man can do so much work and no more. One large company, thinking along these lines, has adopted a system of day quota wages by which the man is practically paid a salary which is independent of the small variations in his work.

My own impression is that as a shop becomes more



almost unbelievable increase can be traced directly to the impulses given by (1) Standardization, in Management Methods. What is important is that this increase is still going on

and more "mechanized" the tendency will be to pay day quotas and that gang rates of payment in such shops will be developed increasingly to stimulate the so-called non-productive labor. This last factor in the wage problem is one indeed that is exceedingly interesting to watch.

Types of workers who formerly were deemed incapable of stimulation to greater work are now having their work time studied, scrutinized and analyzed and are having offered to them scientifically planned incentives for greater work. Such workers are inspection, maintenance or millwright men, tool room men, floor sweepers, window washers and office employees.

Another phase of personnel that is being studied more

and more is that of industrial education. The foreman, long neglected as a management factor, is now coming into his own and is being encouraged to learn more of the industry in its business and technical aspects. Men who formerly would have been pitchforked into positions are now being trained for their work, and the good results are already evident. Education for the job has become a common slogan; more and more men in progressive plants will think about their jobs rather than perform them in a purely routine manner.

Another step in progress that can and should be made by the production committee of the Society of Automotive Engineers is to attempt to standardize job specifications. There is still considerable labor turnover in the automotive industry, much of which could be avoided by a better selection of men. Authorities estimate that it costs an average of some $200 more or less to hire a man and train him for his job, depending upon the amount of skill required. If he quits later the management is faced with a loss of this amount, not to mention the work of going through the training all over again. By utilizing certain elements of a competent psychological and technical test as an aid to selecting workers, the employer will be the better able to pick out those who will stay over longer periods because they are in the right positions. Such tests perhaps might be standardized for the industry and effect tremendous labor economies.

ON this subject of labor turnover, let us remark in passing that there is still too much executive turnover in the industry. This process is an exceedingly costly one as an executive change usually leads to a policy change which disturbs the whole organization.

Management methods are closely allied with questions of personnel but still involve additional problems. One of the signs of the times is the fact that management is bravely meeting those problems and trying to solve them. Perhaps material control, material inventory or material turnover has come in for closest scrutiny during recent periods. A significant move lies in the fact, for instance, that the Marmon Motor Car Co. has practically abolished its conventional storeroom. Henry Ford, in his book "Today and Tomorrow," makes the equally significant statement that his material inventory is practically all in transit.

Everywhere efforts are being made to reduce the idle time of material and make it earn more money by keeping it in productive motion.

Another little thing, but an indication perhaps of much bigger things, is shown in the tale of a Hudson Motor Co. process.

Engine valves for this company are made at Muskegon, Mich. Formerly these valves were taken from the grinding department, packed in crates, shipped in a freight car, placed in the material stores room and then issued against requisitions to the engine assembling department. Today, the valves, after finishing at Muskegon, are placed in racks on a Cowan-Steubing skid. The skid travels by freight car to Detroit and proceeds directly to the assembling department, without the intervention of stores.

"Hand-to-mouth" buying, another of the more recent trends related to management methods, has been adopted by the automotive industry largely to speed up its movement of material. While some problems still remain to be solved in its use, there is evidence that the policy has come to stay.

The extended use of conveyors is still a management problem in moving materials, and in this connection it is worth noting that the value of the conveyor not only as a material handler but as a pacemaker for the workers has become more and more recognized.

There is still a feeling latent in the minds of some manufacturers that conveyor methods are suitable only for the large shop. This is not quite true. It would be more accurate to say that they are applicable chiefly to the specialized or mass production shop with a proviso that many instances will be found where they can be applied to the variety or job shop.

After all, a large shop is but an aggregation of little ones, and when one reads that one company making high-priced cars has just applied conveyorized methods to its case-hardening department, it makes one realize how thoroughly conveyorized we have become.

Incidentally, I had a valuable lesson in this connection when going through the Highland Park plant of the Ford Motor Co. some time ago while it still was devoted to Model T production. I was temporarily dazed by the multitude of lathes and milling machines and grinders and so forth, until my guide, Walter Fishleigh I think, pointed out that handling of mass production and tools was a simple problem of mathematics. He advised me to consider the multitude of machine tools as simply one or two multiplied by a variable factor and further added that it would be well to consider only the one that was typical of the process being studied. By doing this, chaos at once simplified down to a logical sequence of processes. This method of study I have found very practical, tending to simplify the problems of the most complex shops.

The plant of tomorrow will be thoroughly conveyorized in every department and material handling by men will be eliminated. This policy will allow the production men to concentrate their attention on economies in the cutting processes, the handling processes being taken care of automatically.

Following this line of thought, however, there is a problem that keeps on intruding itself. "Will the conveyorized shop make machines out of the men?" After viewing the motion picture "Metropolis" (which I strongly advise all production executives to see) I confess I gave a lot of thought to the mechanizing influences at work in modern automotive production.

"Metropolis" is, of course, purely a poet's imaginative conception of mass production work, and I believe will always remain so. The shorter day, the five-day week, the use of the automobile for pleasure riding and the great democracy of this country will always prevent such conditions from ever coming to pass.

Much attention is being given by management to the policy of waste elimination. The older policy of trying to do something with material after it has been scrapped is being replaced by the modern policy of preventing this scrappage, usually by better inspection. Allied with this policy is that of taking care of the unavoidable wastes that go on in manufacturing.

THE Buick Motor Co., for example, has saved about $200,000 by taking care of the waste materials that would otherwise be thrown on the dump heap. Similar important savings are accruing to many other manufacturers from the same course.

The old Scotch policy of "Every little makes a muckle" is the slogan animating these material conservers. Few big savings are effected in any one lot but an aggregate of little savings reaches the marvelous total.

In each of the Buick manufacturing units the superintendent goes over the scrap personally each day, and

the factory accountant furnishes him with a daily record of its money value. Since 1925 the average scrap loss per car has been cut more than 50 per cent.

The Ford Motor Co. offers another outstanding example. Money saved through the re-utilization of tools and miscellaneous equipment, the recovery of useful products from waste materials, and from the sale of unusable residue as scrap totals near $20,000,000 each year. Management in general is turning its attention more and more strongly to these so-called hidden sources of revenue, and is studying them carefully as they affect workshop and production economies.

Progress in the art of fabrication has made immense strides recently. The specialized machine tool is here to stay in the automotive industry. Processes are not only more economical but are of better quality than ever before. The productive value of floor space is being studied so that compact machines capable of many detailed operations in themselves are being installed to complete a sequence of operations in one cycle. Accuracy expressed in terms of small tolerances or deviations is embodied in these machines so that the finished product is better and cheaper. Limits decreasing from one-quarter thousandth to a tenth of a thousandth are increasingly evident.

The so-called standard machine tool, also, is growing more rather than less important. By the application of special fixtures, production men are maintaining the flexibility of the standard tool and at the same time are reaching a high standard of production. One of the significant details of machine tool design is the attention that is being given to automotive practice. To mention but three items: the use of anti-friction bearings, centralized lubrication and the use of alloy steels are revolutionizing machine tool practice and making for high production records at low maintenance and operating costs.

One of the most significant changes still taking place is in the displacement by grinding of many cutting processes. The grinding machine today is in strong demand when accuracy is demanded. Centerless grinders, the most recent product of the machine tool engineer, were formerly thought to be practicable only for parallel non-shouldered work. Today they are being used for shoulder products and taper products and by their rapidity and accuracy are building more and more life into our low-priced automobiles.

Progress in grinding has stimulated all branches of the machine tool industry. The machine tool designer has wakened from his apathy and scarcely a day passes that some new model machine is not put on the market, making obsolete many previous efforts.

In the manufacturing plants themselves the tool designer's concentration on his jigs and fixtures has made him an important money-saving executive, and his work is becoming more scientific as time goes on.

The tool engineer of today can take the standard versatile machine tool, and by careful study of his fixtures make it the equal of the specialized tool while still retaining the factor of flexibility.

PERHAPS the most interesting developments in production relate to the research that is being done by physicists and other scientists in a field which hitherto-fore has not been studied. Sound measurement by radio amplification devices is now an accomplished fact. It is no longer left to the erratic human ear to determine the volume and quality of noise produced by an erring bearing or gear wheel. The galvanometer needle now acts as a means of measurement from which there is no appeal.

The X-ray is being enlisted in the service of production as a means of determining the characteristics and suitabilities of material for use and fabrication. Delicate measuring devices, formerly available for research laboratories only, are now employed daily in production.

We are indeed only on the threshold of advances in production engineering due to applied science. And so the research goes on for further and further improvements to obtain greater economies. Alvan Macauley, President of the Packard Motor Co., says he will not hesitate to make a change to secure a saving of one quarter of a cent per product, quality being equal or preferably better. Henry Ford calculates cost to 0.01 of a cent. Other executives have expressed similar sentiments.

The production man today (he is not altogether pleased with the title production engineer), like General Joffre, nibbles at his costs, cutting down step by step, until in the aggregate the result is tremendous. Quoting broadly from E. P. Blanchard's valuable paper on "Integrated Production," presented last week before the S. A. E. production meeting, the savings that the production or tool engineer makes are not a local affair, but are playing an exceedingly important part in the present enviable financial situation of the United States. Tracing our present prosperity to its original causes, the production engineer probably more than any other is the major source.

Automobiles of 1927 have infinitely more value fabricated into them than the cars of 1917, and the results are very largely due to the savings effected in modern production.

Highly-Developed Inspection Equipment Speeds Production

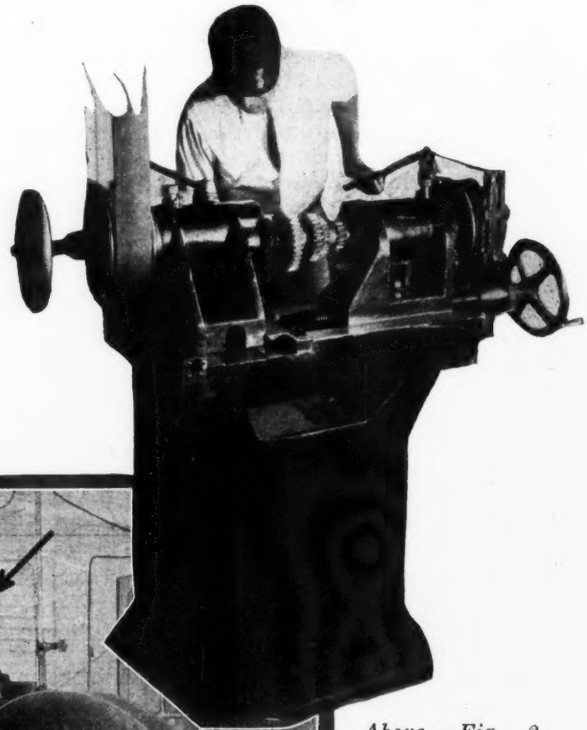
Industry is Constantly Finding New Means of Insuring Accuracy in Mass Production of Parts

By K. W. STIL

CONFRONTED by the two opposing requirements of positive accuracy in all parts and high production schedules, automotive production men have had a particularly difficult problem in providing for adequate testing and inspection of parts and assemblies making up a motor vehicle.

Perhaps too little credit has been given in the past to those men who have designed and developed inspection equipment which has made possible limits in tenths and thousandths even with outputs as high as hundreds or thousands of completed vehicles daily. Without accurate parts, interchangeability would be impossible and servicing of cars on the road would be a hopeless task. Without accurate parts, also, the present dependability and durability of American-built cars would have been impossible to attain.

But with this high degree of accuracy there must also be speed to conform to mass production requirements. Because of this, laboratory methods of inspection, which before the great development of modern automotive production methods, were considered the only way to obtain really accurate measurements, are quite impracticable. In order to attain and maintain its present high status of economical production of high



Above — Fig. 2. Studebaker transmission gears are checked in this machine for burrs and running condition

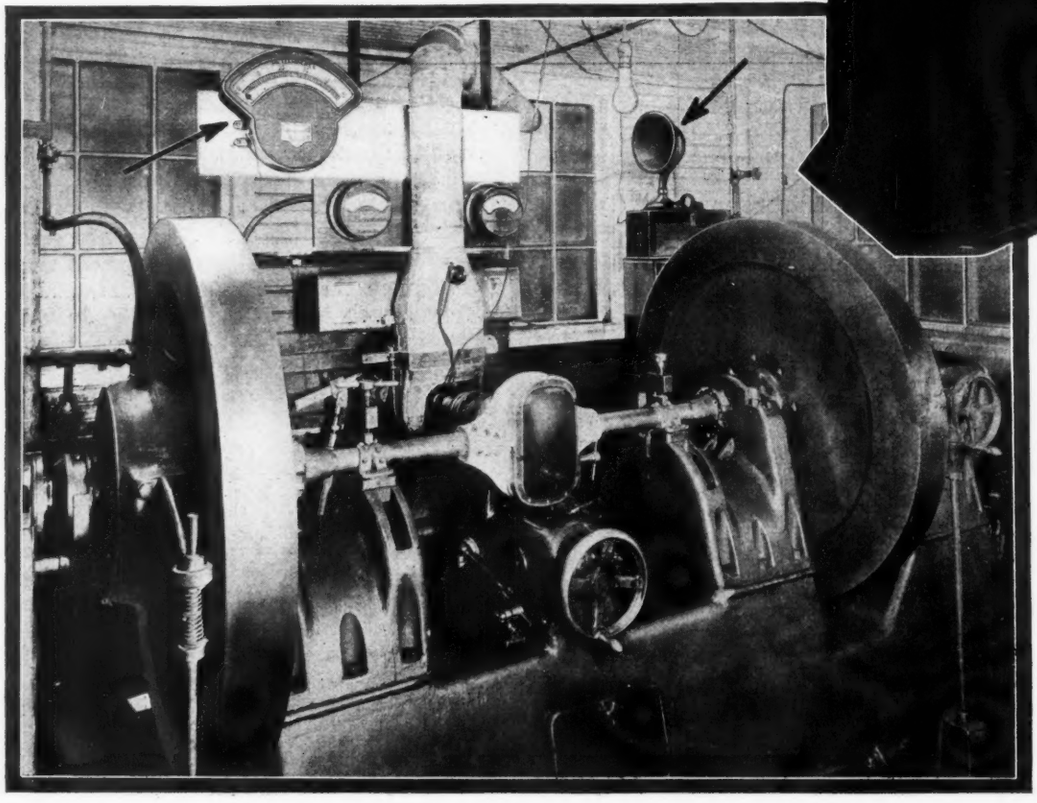


Fig. 1. Equipment employed by H. H. Franklin Mfg. Co. for testing assembled rear axles for strength, rigidity and noise

Equipment *Has* Raised Standards

Specially Designed Devices Are Found in Many Plants—Photo-Electric Cell Offers Possibilities

K. W. STILLMAN

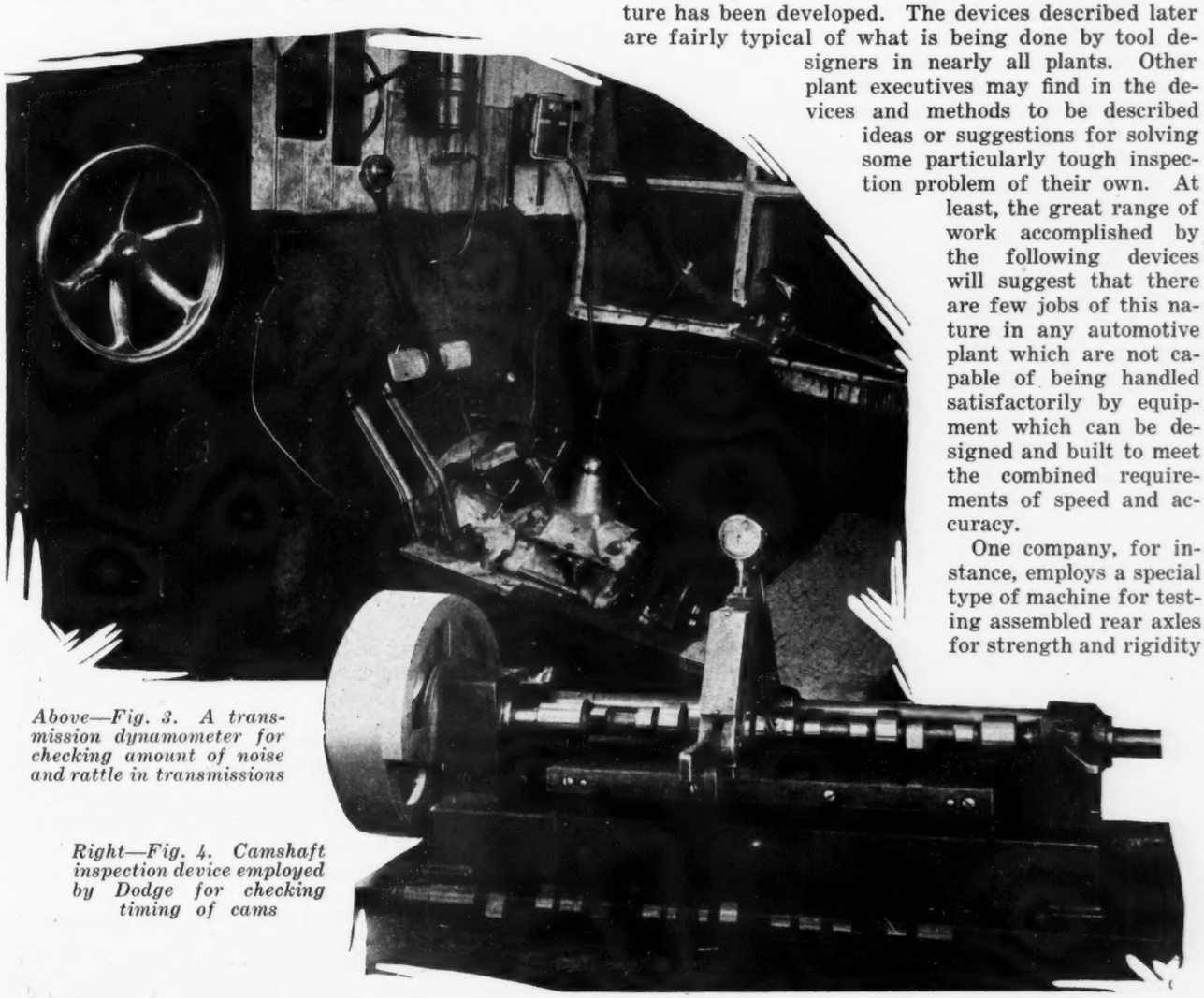
quality products, it has been necessary for the automotive industry to develop testing and inspection devices and methods which would equally combine the qualities of accuracy and speed.

In this development the makers of specialized test equipment have played no small part and there are on the market today machines and equipment which are almost human in their ability to detect, measure and allocate defects, of all kinds in most any type of material, whether finished or unfinished.

Quite as important as this very valuable development in general testing equipment has been the development in individual automotive plants of special devices designed to fill particular test or inspection requirements developed by the product of the particular plant. Devices of this nature cover every conceivable sort of inspection. Sometimes they are based on standard testing equipment, certain detail changes being made to meet more nearly the particular requirements of the job to be done. Frequently, however, they are entirely original designs developed by the plant personnel in response to a specific need.

Investigation in only a few plants, such as Studebaker, Dodge, Franklin, etc., brings to light the fact that a very considerable range of devices of this nature has been developed. The devices described later are fairly typical of what is being done by tool designers in nearly all plants. Other plant executives may find in the devices and methods to be described ideas or suggestions for solving some particularly tough inspection problem of their own. At least, the great range of work accomplished by the following devices will suggest that there are few jobs of this nature in any automotive plant which are not capable of being handled satisfactorily by equipment which can be designed and built to meet the combined requirements of speed and accuracy.

One company, for instance, employs a special type of machine for testing assembled rear axles for strength and rigidity



Above—Fig. 3. A transmission dynamometer for checking amount of noise and rattle in transmissions

Right—Fig. 4. Camshaft inspection device employed by Dodge for checking timing of cams

of their various parts and also for quietness. This machine is illustrated in Fig. 1.

It consists of two flywheels each weighing about 1380 lb., connected to a motor drive which permits them to be run at peripheral speeds approximating 60 m.p.h so that the inertia exerted by them upon the axles being tested will be as nearly as possible like actual operating conditions. Axles to be tested are suspended in the fixture from the spring seats and are securely clamped down, the axle ends being engaged with the two flywheels. These are then driven by a 30 hp. motor and their peripheral speed is slowly brought up to about 40 m.p.h. At this point power is shut off and air operated brakes on each flywheel are quickly applied to bring them to a dead stop within three seconds. This process is repeated three times on each axle tested and, as can be imagined, provides a very severe test on the strength and rigidity of all the parts of the axle.

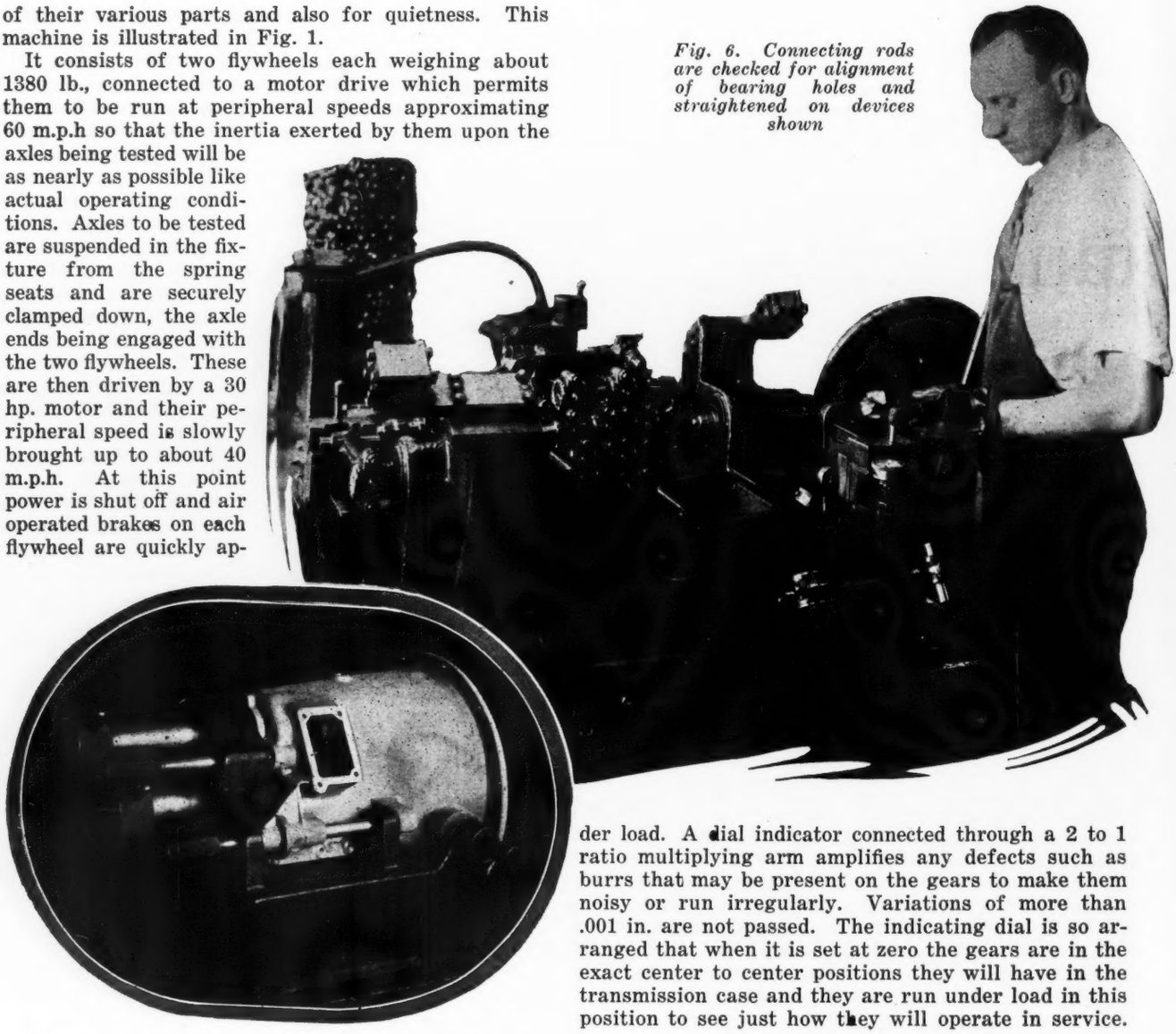


Fig. 6. Connecting rods are checked for alignment of bearing holes and straightened on devices shown

Fig. 5. A fixture for checking the accuracy of machine work on transmission cases

The machine is located in a sound-proof inclosure so that the operator is also enabled to tell if the axles are noisy under these severe conditions. Work is now being carried on by the Franklin company toward the development of methods for eliminating the element of personal judgment in noise inspections. In Fig. 1 the arrows point to a radio loud speaker and a millimeter which are being used in this connection. The purpose is to amplify the noise from the axle and to record its intensity on the millimeter so that the operator can tell from the readings whether or not the axles will pass inspection for quietness. So far this method has not been fully successful.

Transmission gears in another case are checked in a device such as that shown in Fig. 2. In the device the gears are assembled in the same position they will have in the car; a metal-to-metal contact is obtained between engaging gears and they are run under load. A dial indicator connected through a 2 to 1 ratio multiplying arm amplifies any defects such as burrs that may be present on the gears to make them noisy or run irregularly. Variations of more than .001 in. are not passed. The indicating dial is so arranged that when it is set at zero the gears are in the exact center to center positions they will have in the transmission case and they are run under load in this position to see just how they will operate in service.

Testing Assembled Units

Another test for final testing of assembled units is shown in Fig. 3. It is called a transmission dynamometer and is employed for testing assembled transmissions for noise and rattle. A standard Franklin chassis is the basis of this device, the front wheels being anchored to the floor and the rear wheels being mounted on revolving drums which are power operated and so can be used to drive the transmission mechanism.

Transmissions to be tested are mounted in the chassis as shown, arrangements having been made so that loading and unloading of the units may be quickly accomplished by means of the clamps shown in the illustration. The motor driving the drums under the rear wheels is then started and the load regulated by means of the large hand wheel shown at the left of the picture. The transmission is operated under various leads in all four speeds and a very accurate determination of relative amounts of noise and rattle is obtained.

Camshafts are checked in one plant for cam contour against a standard camshaft on a Lees Bradner camshaft inspection machine, a test which is considered of great importance is performed earlier in the pro-

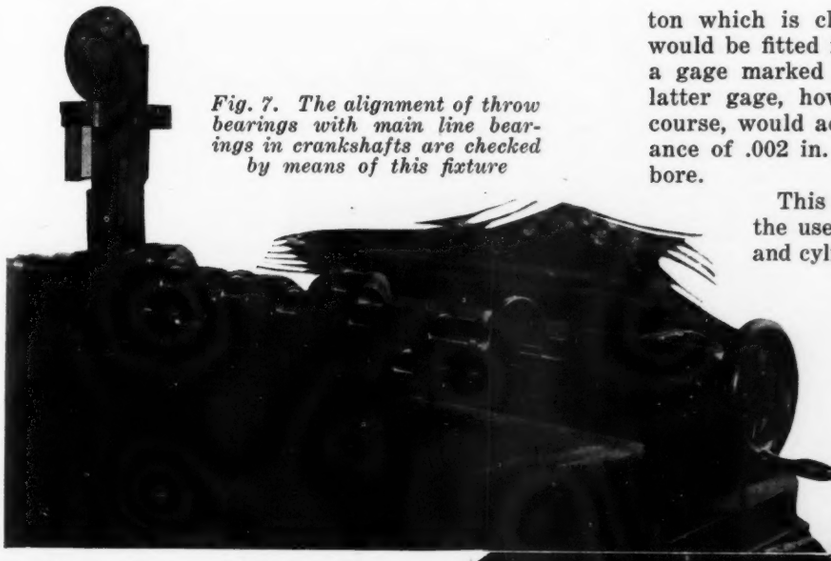


Fig. 7. The alignment of throw bearings with main line bearings in crankshafts are checked by means of this fixture

duction cycle on a device developed in the plant. This is the machine shown in Fig. 4 and is designed to check the timing of cams. It consists essentially of centers upon which the camshaft is mounted and a wheel, shown at the left, attached to one of the centers and so calibrated that the operator can set the shaft for the proper position of valve opening or closing for any cam. An indicating dial is then employed to determine the cam position at both points and thus to check the accuracy of location of the cam and its contour.

Accuracy of machine work on transmission cases is being checked by the interesting fixture shown in Fig. 5, which is designed to check the size and position of main shaft holes, countershaft holes, brake shaft holes, clutch holes and idler gear holes. The large plugs shown are a sliding fit with no shake in hardened, ground and lapped bushings in the heavy cast-iron base and the holes must be bored very accurately or these plugs will not enter.

Considerable time is saved in a Detroit plant in assembling pistons and cylinder blocks and very accurate fits are obtained by a novel means of checking sizes employed there. All finished pistons are checked in a series of ring gages varying in diameter by .0005 in., each gage being stamped with its correct size. These gages are assembled in a rack placed at a convenient height so that the inspector can work very rapidly in determining the size of each piston within .0005 in. Not only does this equipment check for size but also the concentricity of the piston is checked at the same time.

Making Pistons Accurate

After the size determination the piston is stamped with a symbol corresponding to the size and then it is weighed and allocated into weight classes varying by ⅛ oz. The holes in the cylinder block are checked in the same manner by means of a series of large plug gages which also vary by increments of .0005 in. Although these plug gages are stamped with the same size as the corresponding ring gage they actually are .004 in. larger to provide for clearance. Thus a piston which is checked as being 3.3755 in. diameter would be fitted into a cylinder block hole into which a gage marked with this size would just fit. This latter gage, however, and the bore of the hole, of course, would actually be 3.3795 in. to allow a clearance of .002 in. between the piston and the cylinder bore.

This method of checking entirely eliminates the use of feeler gages in assembling pistons and cylinder blocks. Several additional checks of the sizes are made along the line to make sure that they have been determined correctly and that the correct pistons have been used in every case.

Fig. 8. A fixture employed for checking the accuracy of rough front axle forgings

Aligning Connecting Rods

For checking the alignment of connecting rods and for straightening them several devices such as are portrayed in Fig. 6 are employed. The devices consist of a hardened and ground spindle the exact size of the crankshaft bearings upon which the rod is placed. The housing containing the spindle also carries two extensions. One of these, the one at which the operator is working, are two movable arms placed at right angles to each other and connected up through multiplying levers to indicating dials. The two arms each have two fingers placed several inches apart. The plane of one set of fingers is horizontal while that of the other set is vertical and they are placed so that when a piston pin is placed in the connecting rod on the main spindle and the rod brought down to the blocks containing the fingers the latter will just touch the pin in four places on the two planes.

The indicating dials are set to zero by the use of a master rod and piston pin. Then as production rods are placed in the fixture any variation from zero shown on either of the two dials indicates a crooked

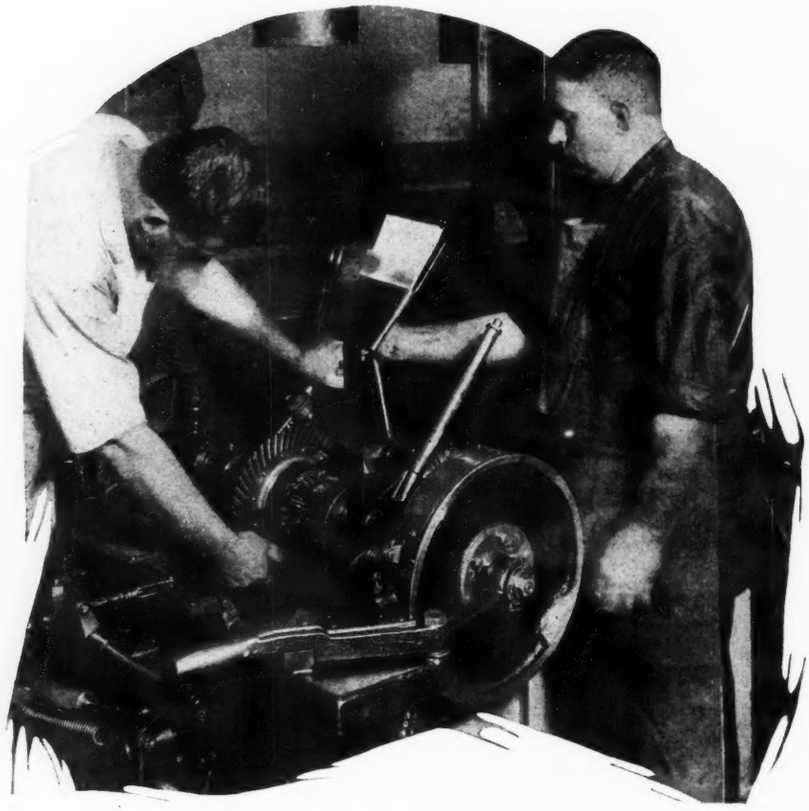


Fig. 9. Assembled differentials are checked for noise, mesh and back lash on this dynamometer

rod or piston pin hole not in alignment with the big hole. The operators correct the error by means of the special wrench shown in use in the illustration and these corrections are continued until both dials read within the allowable limits. Then the rod is swung about its spindle to the upper arm where a gage is fixed to determine if the small end of the rod will now fit into the piston.

Checking Bearings

Fig. 7 shows a semiphore fixture used for checking the alignment of each throw bearing with the main line bearings. The crankshaft is centered in the fixture and slowly revolved by hand while an Ames Indicator, shown at the left, records the amount of misalignment in thousandths of an inch.

Considerable waste of machine operations is saved through the use of a device for checking front axle forgings before any machine work is performed on them. This fixture, shown in Fig. 8, is a simple device which checks the axle for length, for the angle of the king pin and for the squareness of the king pin bosses. The inspection takes a very small amount of time but quickly detects forgings which can not be machined into passable axles. Just before this inspection is made all axles are Brinelled in two places.

In Fig. 9 is shown equipment developed to finally inspect assembled differentials for back lash, noise and mesh. It consists of a fixture into which the differential is set and locked, a 15 hp. motor to drive the gears and braking mechanism by means of which loads can be put on the differential. In the illustration the operator is inspecting for amount of backlash by means of a dial indicator. The bearings are set up and tightened and then the equipment is run under load of varying amounts to determine whether the gears are meshing properly or if the differential is noisy. This test is run in a room partitioned off from other operations so that the noise determination may be more exact.

In order to eliminate any machine work on crankcase castings which do not have the proper outline or in which cores have been improperly located the inspection figure shown in Fig. 10 is used to check all rough castings. The fixture is designed to be loaded and unloaded quickly and its use entirely prevents waste in doing machine work on castings which might later prove to be incorrectly made.

Another type of inspection device which is coming into greater use constantly since its introduction to production men a year or so ago is the photo-electric cell. There follows a rather complete description of how a photo-electrical cell is being used by Western Electric Co. for determining insulation resistance in telephone cable terminal cases. While this is not of direct automotive application the possibilities for use of this type of equipment for many kinds of inspection will be at once apparent.

The insulation resistance is determined by measuring the extremely small amount of current that flows from one terminal through the insulation to the other. This measurement is made by means of a very sensitive reflecting galvonometer which consists of a small coil of copper wire to which is atached a tiny mirror. This is shown at **G** in Fig. 11.

Photo-Electric Inspecting

A very small amount of current flowing through the coil is sufficient to cause it to rotate and the amount of rotation is indicated by means of a beam of light reflected from lamp **L** by the mirror attached to the coil. Formerly the amount of current passing through was determined by observing the travel of the reflected beam across a graduated scale but with the adaptation of the photo-electric cell to the work the inspection is made automatically without the need

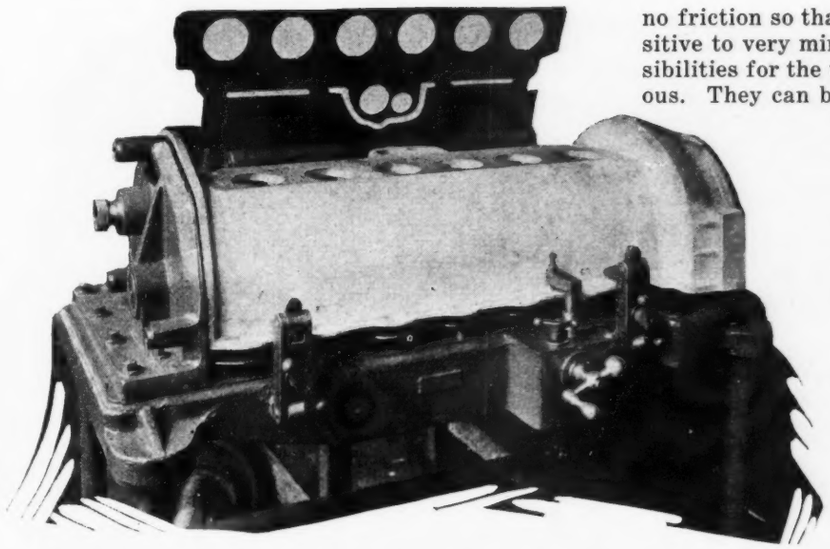


Fig. 10. Rough crankcase castings are checked with this fixture to avoid machining incorrect pieces

for an observer to check deflections.

The photo-electric cell is a vacuum tube, somewhat similar to a radio tube, but with two electrodes and so constituted that the amount of current it transmits is controlled by the intensity of light passing through it.

The light from lamp **L** passes downward through a series of lenses, is reflected onto the galvanometer coil mirror, back to a diagonal mirror, up to the mirror **M** and down to the photo-electric cell through a narrow slit in the top box **B** which contains the cell and protects it from light.

It is evident that any rotation of the galvanometer mirror will cause the beam of reflected light to travel across the top of the box and by means of a graduated scale there the amount of its movement may be measured.

In practice here, as in most measurements, it is not necessary to measure the actual amount of current that leaks through the insulation but only to determine that it does not exceed a certain specified amount, in other words it must be held within limits. To test for this the slit in the top of the box is adjusted by means of a little slide so that the beam of light when deflected by a current within the allowable limits falls inside the slot while a current above the allowable limits falls outside the slot.

Methods Explained

The current, passing through the photo-electric cell, controlled by the beam of light, is amplified by the vacuum tube amplifier **A.** This amplified current, by means of a relay maintains an electric contact so long as the beam falls on the photo-electric cell, or, in other words, as long as the current is within the allowable limits.

If, because of low insulation, the beam does not fall in the slot, the drop in current permitted to pass through the photo-electric cell allows the relay contact to open the circuit of the magnetic clutch and the testing machine stops.

The use of this machine results in a saving of about $12,000 yearly and does away with the tiresome job of watching the reflection from the galvanometer mirror.

Light is made use of because it has no inertia and no friction so that it acts with no time lag and is sensitive to very minute changes in conditions. The possibilities for the use of such devices as this are numerous. They can be designed to determine limits of linear dimensions, temperature, condition of surfaces as indicated by their light reflecting capacity and for many other similar things. Once set in operation they are automatic in action and can be arranged to ring a bell, light a lamp, stop operation—as the one just described does—or to take other ways for calling the attention of the operator to the fact that a piece being tested is not within the allowable limits.

Another way in which photo-electric cells can be used for inspection purposes is illustrated by an equipment developed at the Packard plant to determine the character of finish given to various metal parts which depend upon a smooth surface for best operation. Light is reflected from the surface to be tested to a photo-electric cell, the current set up is amplified through an ordinary radio amplification device and current variations are read. The amount of light reflected is directly proportional to the surface of the metal so that the current permitted to pass through the cell when compared with that passing through when the light is reflected from a surface of standard smoothness gives a direct comparison of the relative perfection of the surface under test. Many other adaptations of this principle are almost self-evident.

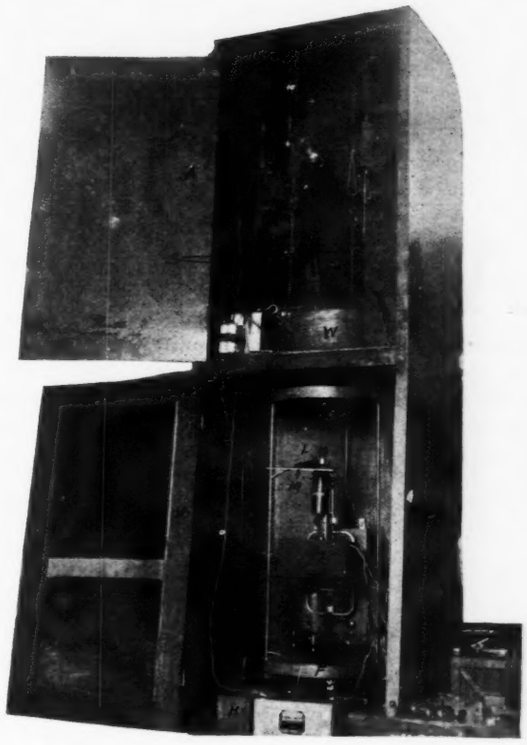


Fig. 11. Photo-electric cell device suitable for many kinds of inspection. Here it is being used to detect excess current leakage through telephone terminal cable cases.

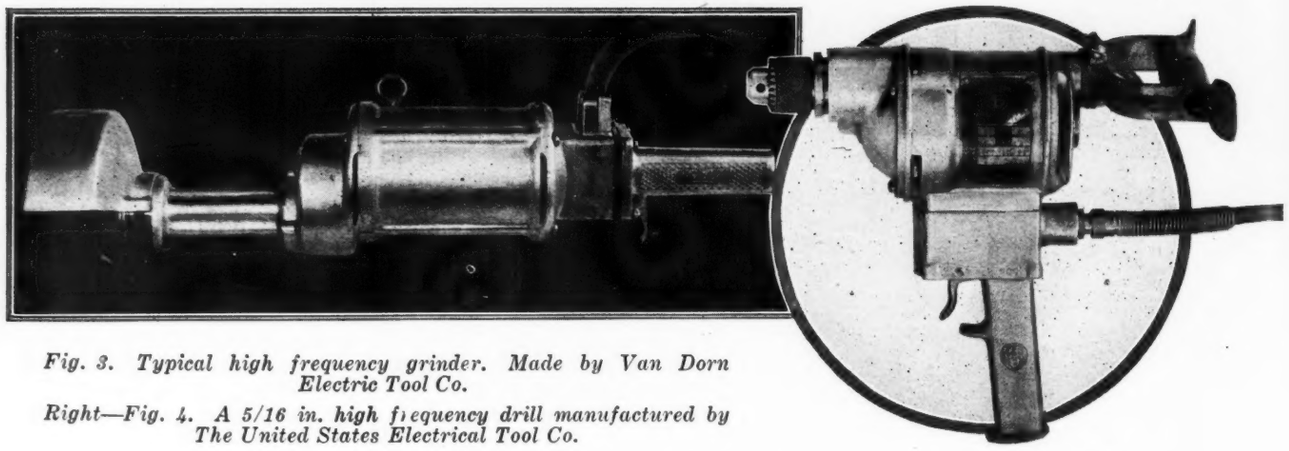


Fig. 3. Typical high frequency grinder. Made by Van Dorn Electric Tool Co.

Right—Fig. 4. A 5/16 in. high frequency drill manufactured by The United States Electrical Tool Co.

High-Frequency Portable Tools

Cost of many operations materially reduced by their use

A RATHER recent development in the portable tool field and one which appears to be of considerable importance from the standpoint of production economies is the type of tool powered with a polyphase induction motor operated on high-frequency current—usually 180 cycles.

The principal feature of this type of tool appears to be the greatly increased speed under load which can be obtained with it as compared with tools operating on direct or low frequency alternating current. The speed of an induction motor is directly proportional to the frequency of the current supplied to it. Thus, changing the frequency from the usual standard of about 60 cycles to 180 cycles multiplies the synchronous speed by three, or increases it from 3600 r.p.m. to 10,800 r.p.m. for a two-pole motor. This high-speed motor can be geared down to produce greater torque for the same weight or the weight of the tool can be decreased considerably if only the same torque is desired as is obtainable from the tools of other types.

Auxiliary Equipment Needed

The principal disadvantage of high-frequency tools appears to be the rather high cost of the auxiliary equipment which must be installed in order to operate them. Alternating current at 180 cycles is not standard in manufacturing plants, at present at least, so that a motor-generator set or frequency changer must be installed to convert the available current supply to that required for operating the tools. In addition to this many plants would have to be wired for three-phase current before high-frequency tools could be placed in operation in them.

Power, of course, can be resolved into two components—torque, or the measure of turning ability, and speed of rotation of the armature or rotor. With the same power available the speed can be high and the torque low or the speed can be low and the torque high. Various types of motors differ considerably in their speed-torque characteristics and various speed-torque relationships are desirable for particular kinds of tools. It is the function of the gear train in the tool to supply the proper relationship between speed and torque so that the tool will best meet the particular requirements of the work it is designed for.

For most purposes, electric motors used in portable tools should have, preferably, comparatively high speeds and low torques in order to furnish the greatest amount of power with as little weight as possible.

The types of electric motors most frequently used in the past for portable tools have been direct current

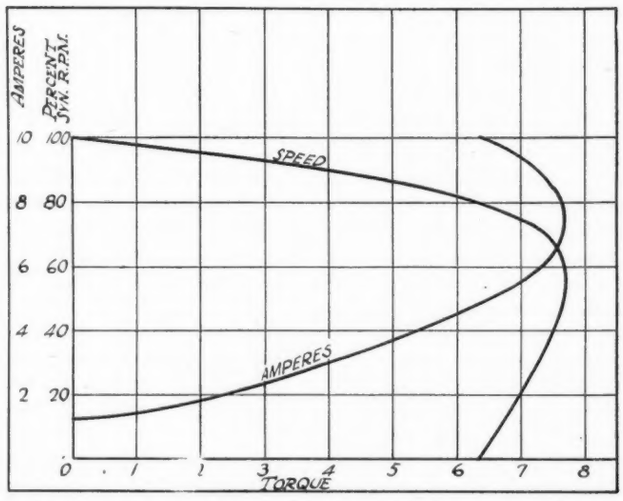
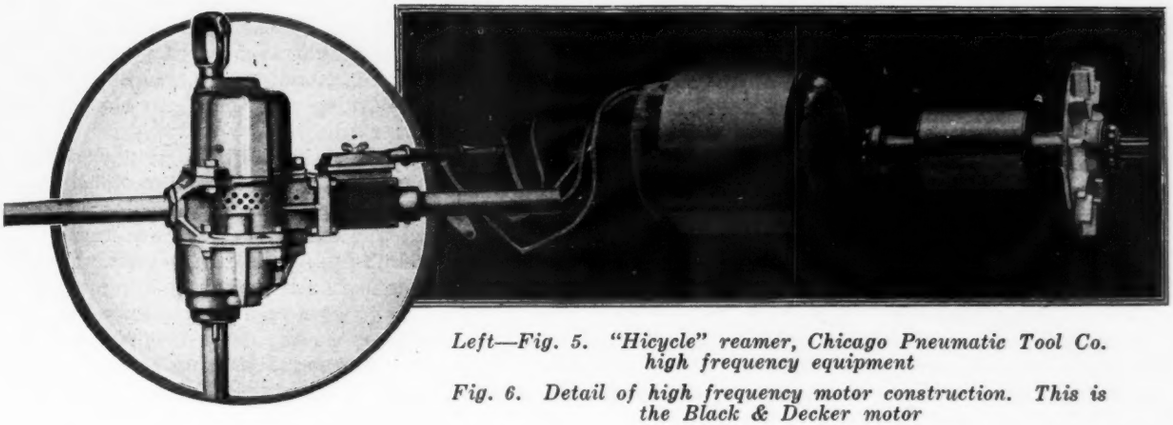


Fig. 1. Speed-torque curve of squirrel-cage type induction motor



Left—Fig. 5. "Hicycle" reamer, Chicago Pneumatic Tool Co. high frequency equipment

Fig. 6. Detail of high frequency motor construction. This is the Black & Decker motor

Effecting Economies

motors, single-phase, alternating current motors, and a series-wound combination of these two known as the universal motor. The universal motor, which, possibly, has been most commonly employed for portable tool work, is of such a nature that under increasing torque-load its speed rapidly decreases. When overloaded, such a motor produces very high torque at very low speeds, the maximum torque being developed at standstill. Such characteristics are obviously desirable in tools such as drills, reamers and taps because it is very hard to stall such motors when properly applied to the job.

Constant Speed for Grinding

For grinding work, on the other hand, a constant speed is desirable since grinding wheels are designed to work best at certain specific speeds. For such work, then, a universal motor is not particularly suitable but something like an induction motor with low resistance rotor, one of whose characteristics is a drop in speed under load of from 5 to 10 per cent from no-load speed as compared with about 50 per cent for universal motors, is indicated.

In view of these two different operating requirements, some portable tool manufacturers have found it desirable to develop two distinct types of polyphase induction motors for use with high-frequency tools. For grinding work the ordinary squirrel-cage type of motor is eminently suitable, while for drilling, reaming and tapping a motor with high rotor resistance, which gives it more nearly the speed-torque characteristics of a universal motor, is considered more desirable. Other concerns, however, see no need for two types of motors but give their drilling, reaming and tapping tools considerable reserve power with which to overcome the possible disadvantage of the squirrel-cage type motor when used in this sort of work.

For grinding work, which we may consider first, the induction motor did not appear to have any great advantage over the universal motor when the only sort of induction motor available was a single-phase, 60-cycle motor, made into a split-phase type for self-starting. The power-weight ratio was about the same for both types—a grinder developing about 1/3 rated horsepower weighing about 20 or 25 lb. when equipped with either type of motor.

But just as the universal motor had the serious disadvantage of slowing down under load so that grinding would be impossible at the full capacity of the wheel, the single-phase motor had the disadvantage,

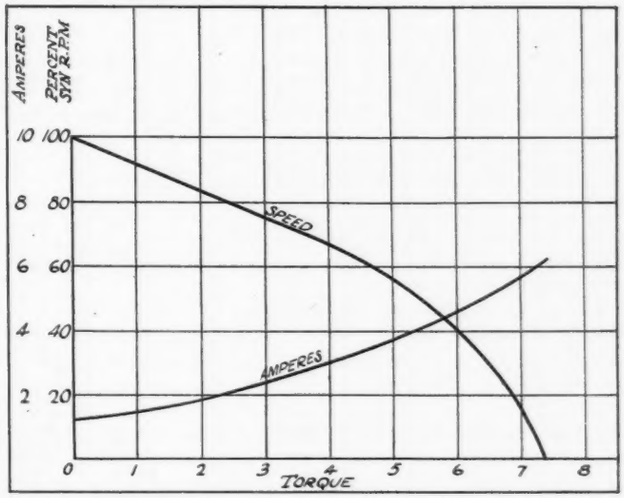


Fig. 2. Speed-torque curve of induction motor with high rotor resistance

when overloaded, of suddenly stalling, with the possibility of burning out the starting windings.

For use where two- or three-phase, 60-cycle current is available there are a number of portable tools on the market fitted with polyphase induction motors. For the same weight such motors develop about 75 per cent more power than single-phase machines and for light work they have proven quite satisfactory.

In view of the very severe service required of portable tools of all kinds, particularly in automotive plants, it was natural for makers of such tools to investigate the possibilities of developing equipment which would more nearly meet the exacting requirements than those available. The outcome of these investigations has been the introduction, during the past year or two, of portable tools for all purposes built around induction motors operating on three-

phase 180-cycle current.

The use of 180-cycle current instead of 60-cycle, for example, triples the synchronous speed of motors

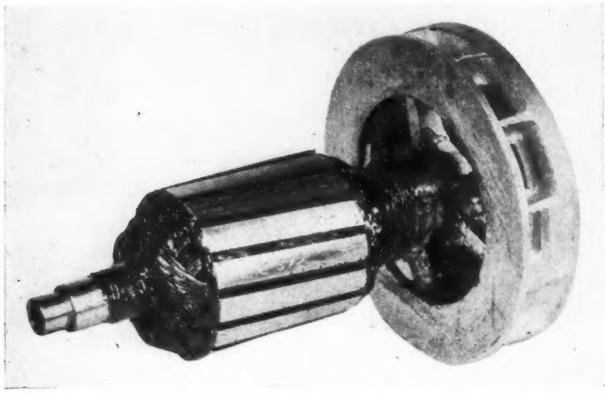


Fig. 7. Van Dorn uses this wound rotor with resistance ring cast in the fan for motors operating drills, taps, reamers, etc.

so that a two-pole motor of the new type has a no-load speed of very nearly 10,800 r.p.m. This greatly increased speed under load made practicable with high-frequency equipment is the whole secret of the success of the new type of tool. It is well known that the power developed by a motor is a function of its speed, so that increasing the speed permits a like increase in power if torque requirements are not changed. This fact has been utilized by makers of high-frequency equipment to provide three distinct advantages in the new tools, or combinations of them.

First, in machines of the same weight as those formerly used, the full speed can be utilized to greatly increase the developed power without changing the torque. Second, the motor can be geared down to greatly increase the torque and to provide increased power with the same weight. And finally, speed, power and torque, similar to that obtained with the older types of tools, can be obtained in high frequency tools with greatly decreased weight.

In the design of most high frequency equipment two or three of these possibilities have been combined to give speed-torque characteristics particularly adapted to the work to be performed by the tool. Grinding wheels have been constructed for use at speeds not much greater than the no-load speed of universal motors or about 3600 r.p.m. Therefore, in designing high-frequency grinders, the rotor has been geared down from 10,800 r.p.m. to about this speed and, since all the increased power and torque made available by the gear reduction is not necessary for the work, the whole equipment is made lighter and smaller.

Same Principles Followed

The same principle has been followed in the design of other types of tools, but the details have been differently handled because of the various speed-torque characteristics desired in tools such as taps, drills and reamers, which are subject to sudden overloads.

The practical results of this development may be seen in comparative performances of low and high-frequency tools made by the same companies. The usual weight of a universal-motored grinder developing about ½ hp. is about 25 lb., while a high-frequency grinder developing from ¾ to 1½ hp. weighs about 15 lb.

In grinding work, the high-frequency equipment compares favorably with universal motored electric or air tools. These latter tools slow down considerably under load, the maximum decrease under normal loads often being as much as 50 per cent. This is an especially bad condition in grinding, for a wheel that is coarse enough to give rapid abrasion with a fairly smooth finished surface at speeds of 3600 r.p.m. would be likely to score the surface being ground when the speed is reduced to 2000 r.p.m. or less and, of course, under these conditions the production speed would be very much lower. Similarly, if a fine wheel were used to insure a smooth finished surface, while production speed at 3600 r.p.m. might be fairly good, at

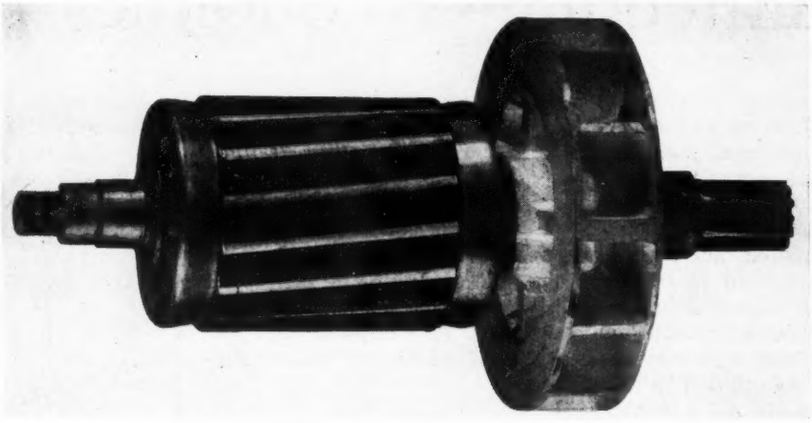


Fig. 8. Detail of Chicago Pneumatic high frequency rotor. It is of the squirrel cage type but bare copper wires are employed instead of copper bars

lower speeds it would be too slow to be satisfactory on production jobs.

As a compromise many plants made use of two wheels for each grinding operation, particularly where a good finished surface was desirable. A roughing cut was first taken with a coarse wheel which would remove stock rather rapidly but would leave a rough finish. Then a finish grinding cut would be taken with a fine wheel merely to dress the surface.

With the advent of high-frequency tools this method was no longer necessary. Under normal loads the speed of polyphase, squirrel-cage type induction motor will not be more than 10 per cent under the synchronous speed so that with a 3 to 1 ratio gearing hooked up with the 180-cycle, two-pole motor, the loaded speed of the grinding wheel will be about 3300 r.p.m. This speed has been found great enough to permit the use of fairly coarse grinding wheels which are capable of rapid removal of stock and also of leaving a surface smooth enough for most ordinary requirements.

Another factor which works to the advantage of high-frequency equipment is the lessened effort which the operator of such tools must expend. Tools with large slip and which were also heavy could not be rested full weight on the work lest their speed be lowered to such an extent that no work would be done. Therefore, it was necessary usually for the workman

to hold the tool a little off the work in order to obtain maximum results.

With high-frequency tools the speed, under all normal load conditions, remains fairly constant and they usually possess considerable reserve power so that not only can the full weight of the tool—which is much less than that of the older tools—be rested on the work, but the operators of these tools are accustomed to lean on them a little to still further increase their cutting speed.

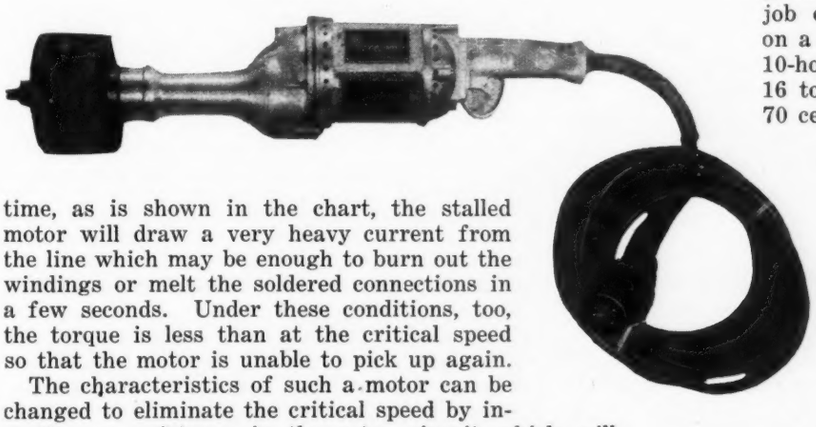
The usual type of motor employed in high-frequency grinders is the squirrel-cage. It is a fortunate coincidence that, while this type of induction motor has the electrical characteristics most suitable for grinding work, it also has a relatively high resistance to mechanical troubles because of the absence of brushes and commutators in its construction.

The Problem in Design

In the design of motors for use with drills, reamers and similar tools the main problem involved seems to be the elimination, at least within the normal operating range, of the critical speed or stalling point and provision of as great a starting torque as possible. Fig. 1 shows a typical speed-torque curve for an induction motor having normal rotor resistance, such as the ordinary squirrel-cage type motor.

Since the torque requirements for grinder work are normal and the likelihood of overloading is small, this type of motor is quite satisfactory, particularly in view of its close speed regulation. For other types of work, however, where there are possibilities of frequent sudden overloads, a motor capable of developing great torque at low speeds and at standstill appears to be more desirable.

For the type of motor pictured in Fig. 1, a sudden increase in the load such as may occur in reaming and drilling may, if great enough, quickly bring the motor to its critical speed and stall it. At the same time, as is shown in the chart, the stalled motor will draw a very heavy current from the line which may be enough to burn out the windings or melt the soldered connections in a few seconds. Under these conditions, too, the torque is less than at the critical speed so that the motor is unable to pick up again.



The characteristics of such a motor can be changed to eliminate the critical speed by inserting a resistance in the rotor circuit which will reduce the line current drawn at starting and when stalled so that the heat produced in the windings is greatly reduced. The addition of such a resistance will give the motor speed-torque characteristics similar to those shown in Fig. 2 which are about the same as those of a universal motor. As the load increases the speed will decrease at a fairly uniform rate to the stalling point when the torque will be at its minimum. The rated load speed, under these conditions, will be only about 25 per cent lower than no-load speed, as compared with the 50 per cent drop for the universal motor.

Similar conditions have been met with in the application of polyphase induction motors to crane and elevator service and the use of a slip-ring type motor with a resistance in its rotor circuit has proved to be very satisfactory. This method is not adaptable to portable tool work, however, because of the amount of complication and weight which such construction would add to the installation.

One company has designed a special rotor which is wound like a slip-ring rotor but with the slip-rings omitted and the three leads from the windings connected to a resistance ring cast in the fan, as shown in Fig. 3. Such a motor has speed-torque characteristics similar to those shown in Fig. 2 but also has a somewhat lower operating efficiency under normal loads because of the presence of the extra resistance when not needed.

Other concerns solve this problem with squirrel-cage type motors which have sufficient reserve power so that there is little likelihood of ever bringing the motor to its critical speed when it is employed in the work for which it has been designed. These motors, of course, have speed-torque characteristics similar to those shown in Fig. 1 and have the advantage of closer speed regulation than can be obtained with high resistance rotors. They are constructed with reserve power so that only very exceptional torque loads will bring the motor to its critical speed and stall it.

From the information given before it will be obvious to all production executives that high-frequency tools offer very definite advantages over other types of tools, for certain installations, at least. To give a better picture of what they accomplish a few cost comparisons may be of interest to show what results some users of high-frequency equipment have obtained.

Finishing Spot Welds

A large body plant substituted high-frequency grinders for another type of grinder on a job of finishing spot welds without filing on a production schedule of 2000 pieces per 10-hour day. With the former equipment 16 tools were required, at a power cost of 70 cents each per day, while the piece work price for the job was 5 cents. The total cost of a day's output with the old equipment was $111.20.

Fig. 9. Another high frequency grinder. This is a Black & Decker product and is fitted with a buffing wheel

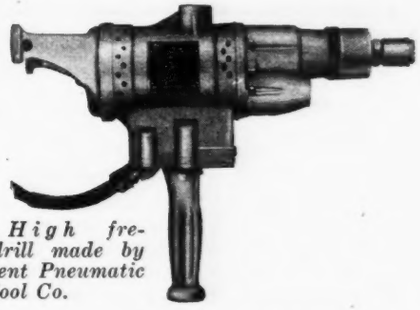


Fig. 10. High frequency drill made by Independent Pneumatic Tool Co.

With high-frequency equipment only nine grinders are required for the same output, and the power cost per tool is only 13 cents per day. The piece work price has also been reduced to 2.75 cents because of the greater output possible and the less fatigue caused

by the lighter tools. The total cost of a day's output with these tools is $56.17, a saving of over $55. The monthly saving of high-frequency tools over those formerly employed has been about $1,375.

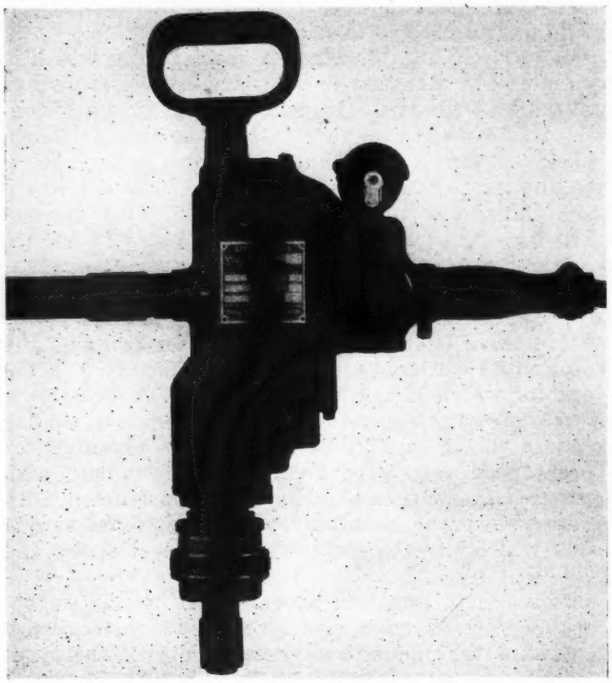


Fig. 11. Chicago Pneumatic nut runner. Main switch in handle, reversing switch on top of handle, friction clutch on spindle for nut running and stud driving

In a large car manufacturing plant comparative tests were made between high-frequency tools and another type of equipment used in tightening rim nuts on a wheel assembly. In this work the greater power of the high-frequency tool permitted speeds of 750 r.p.m., while the other equipment ran at 350 r.p.m. Thus the former were about twice as fast. The power cost for the high frequency tools was 16.2 cents per nine-hour day and for the former tools $1.86, a difference of nearly $1.70. Another advantage of high-frequency tools in this sort of work was the better product turned out. With the old tools the tension of the nuts was not uniform and had to be checked and adjusted by hand. The clutch on the high-frequency tools could be adjusted so that it would automatically release at the same torque for each nut, thus practically eliminating the use of a hand wrench for adjusting tension.

Manufacturing plants now are not regularly supplied with alternating current at frequencies of 180-cycles, although some plants, particularly those engaged in wood working, have made considerable use of frequencies up to 120-cycles for long periods. Thus, the first expense in putting high-frequency equipment in service is that caused by the necessary installation of a frequency changer or a special motor-generator set to convert the current supplied the plant to the type required by the tools.

In addition to this equipment, most plants will have to be wired for three-phase current before the new tools can be placed in operation and the total of all these expenses is likely to limit the application of high-frequency tools for the present to plants where a sufficient number of them can be employed continuously to justify the expense of the installation. Just how many tools this would mean is uncertain and probably varies with particular circumstances. Even the manufacturers of high-frequency equipment are in considerable disagreement over this point. As an average of their conflicting opinions it appears that the minimum number of tools which would make a high-frequency installation economical is not less than ten.

It is a fairly simple matter to estimate the probable cost of converter equipment for a high-frequency installation but the probable cost of installing the three-phase wiring system will vary greatly with the particular conditions to be found in each plant.

A quick way of estimating the converter capacity required is to add the ampere ratings of all the tools to be used, multiply the sum by the estimated load factor—or the probable proportion of machines which will be working simultaneously—and multiply this product by 0.3 to give the kilowatt capacity of the required converter equipment.

For example, suppose that 40 tools are to be operated, each of them being rated at 2.5 amperes. The total amperage rating would be 100 amperes. Assuming a 40 per cent load factor, the result would be 100 x 0.40 x 0.3 or 12 kw., the estimated size of the required converter equipment.

Meetings and Shows Reported in This Issue

THE eyes of the industry last week were focused on production problems and developments in two cities, Cleveland and Detroit. During the week two expositions, containing all the latest designs in machine tools, heat-treating and welding equipment and testing devices, were in progress, and technical sessions dealing with production were held by four different bodies.

Cleveland housed the exposition of the National Machine Tool Builders Association and was the scene of several sessions of the Society of Automotive Engineers.

Switching to Detroit, the S.A.E. concluded its sessions there, in the midst of the Steel and Machine Tool Show and technical sessions of the American Society for Steel Treating, a meeting of the American Welding Society and a gathering of the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers.

Automotive Industries was represented at all of these events by staff men and developments of automotive interest in each case are reported in a later section of this issue.

Material-Handling Methods

25 *Examples of Modern Practice in Automotive Plants*

By K. W. STILLMAN

As the amount of information about automotive mechanical handling equipment and methods has increased it has become recognized that while each of the numerous types of equipment possess characteristics distinct from other types no single type is suitable for all the jobs to be found in the average plant.

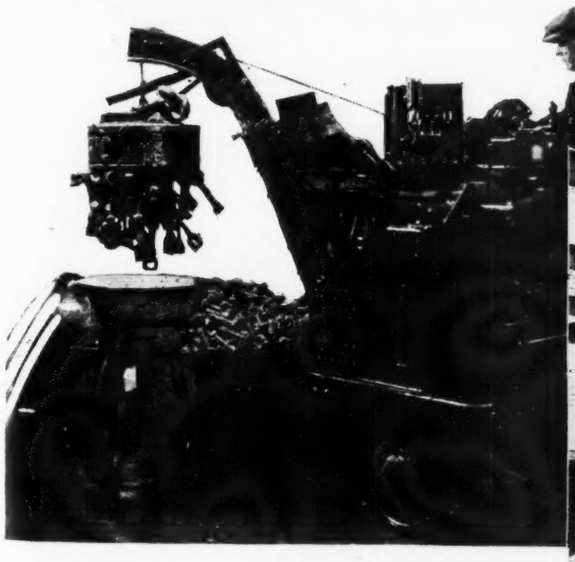
Job analysis for material handling tasks is now common in automotive plants. It is generally believed that for any particular job of moving materials there is one type of equipment which, under the conditions surrounding the job, will furnish the most satisfactory and economical service. The big job in making installations, then, has become that of selection of the proper type for use in particular situations so that now it is rare to find an automotive plant of any size in which at least a few representatives of almost every type of material handling equipment are not being used with profit.

In applying standard equipment to specific jobs, however, the particular problems met with in individual plants often make necessary changes from standard design and installation practice in order that the equipment shall more nearly meet the exacting requirements of the job. Just as a suggestion as to what is being done along these lines of adapting standard mechanical handling equipment to specific needs there are given below descriptions of a number of such installations covering a wide range of service, nearly all types of equipment and all sorts of automotive plants.

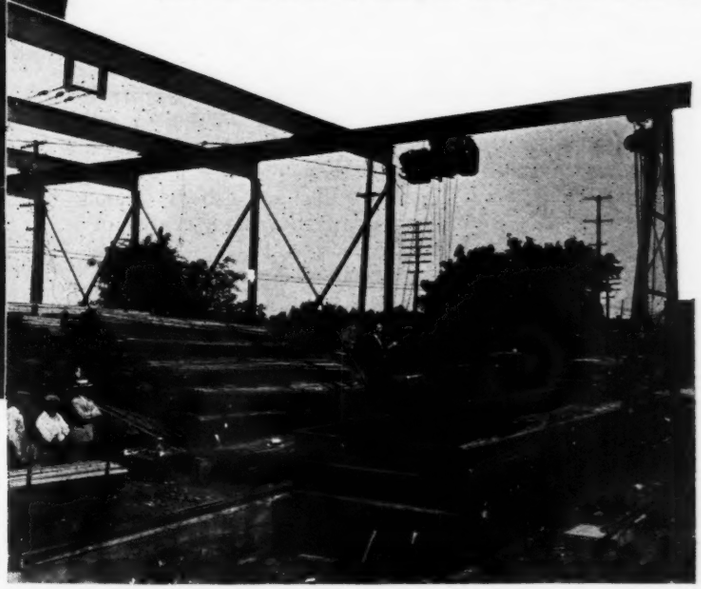
1—*Unloading Freight Cars*

One of the most useful purposes to which material handling equipment can be put and one which is usually very economical because of lowered labor costs is that of unloading freight cars.

Fig. 1 shows a Baker Raulang crane truck, equipped with a Ready-Power gas-electric unit, which is employed by a large automobile company in unloading loose connecting rod castings



Above—Fig. 1. Bagging castings with crane truck fitted with magnet



Right—Fig. 2. Overhead trolley hoists employed for unloading freight

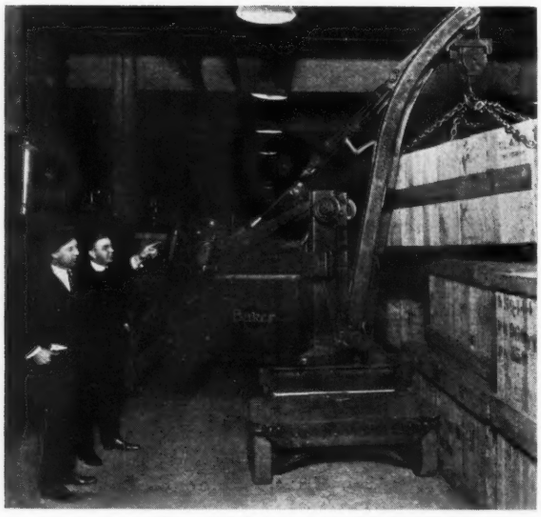


Fig. 3. Crane trucks used for tiering crates of glass

and bagging them. The crane is equipped with a 20 in. magnet and will unload a carload of loose castings of this nature in about 45 min., a job which formerly required the services of three men for four hours each to accomplish.

2—*Electric Trolley Hoists*

Electric hoists mounted on overhead trolleys also can be economically employed for this work, particularly for unloading flat cars or gondolas. Fig. 2 shows two Chisholm-Moore hoists and trolleys employed in the yard of the Wolverine Bumper & Specialty Co. for unloading sheets and strip steel from such cars and piling it.

3—*Crane Trucks*

Considerable handling can be saved if the equipment unloading the cars can convey its load directly to the storage space and place it in position there. For carrying on such work with such heavy and bulky objects as crates of plate glass destined to become automobile windshields and windows, an equipment such as the Baker 3000 lb. crane with 60 in. wheelbase and 8 ft. boom shown in Fig. 3 is particularly suitable. In the large body plant where this equipment is in operation, crates of glass are picked up in the freight cars and are carried to the storage room and stacked without rehandling.

4—*Handling Engines*

A number of miscellaneous movements of materials for short distances are handled in various ways. Fig. 4 shows a Shepard Electric hoist mounted on overhead rails which is used in the Marmon plant to convey completed engines.

5—*Buick Uses Trucks*

Fig. 5 illustrates a specially designed Elwell-Parker truck used at the Buick plant in Flint for hauling finished motors. The particular service here is to take the engines from the final test stands and convey them to freight cars for shipment, a distance of several hundred feet. The equipment has been designed to eliminate any excess jarring of the completed units during the journey.

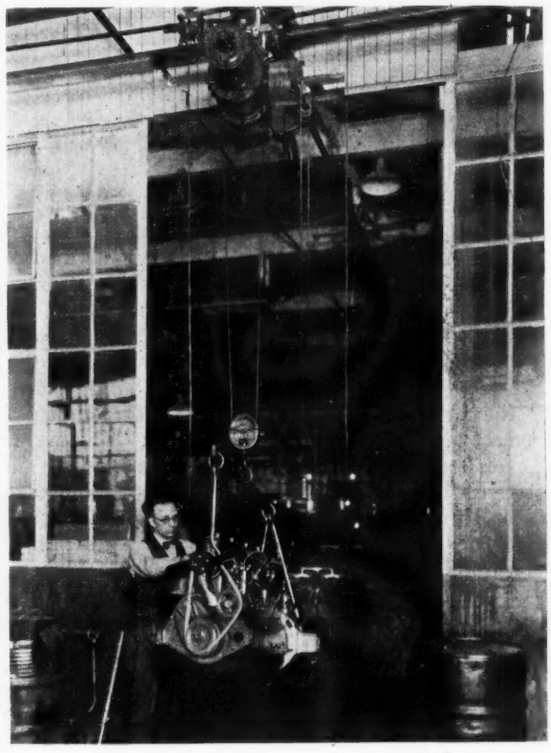


Fig. 4. Trolley hoists transporting finished engines

6—*Moving Pontiac Bodies*

The start of the line which carries completed bodies to the final assembly line in the new Pontiac plant is shown in Fig. 6. The finished bodies arrive at this point on an endless conveyor running in a covered passageway which connects the assembly plant with the body plant and are here removed from the conveyor and placed on

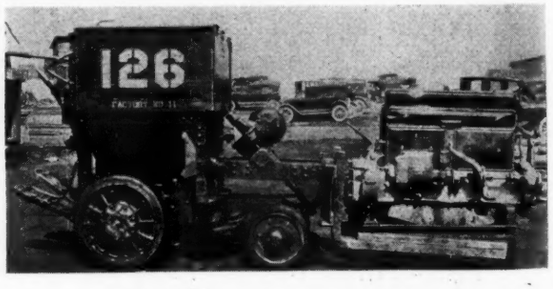
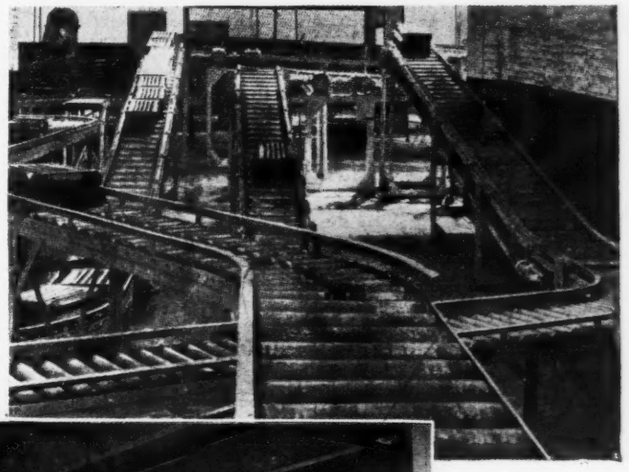


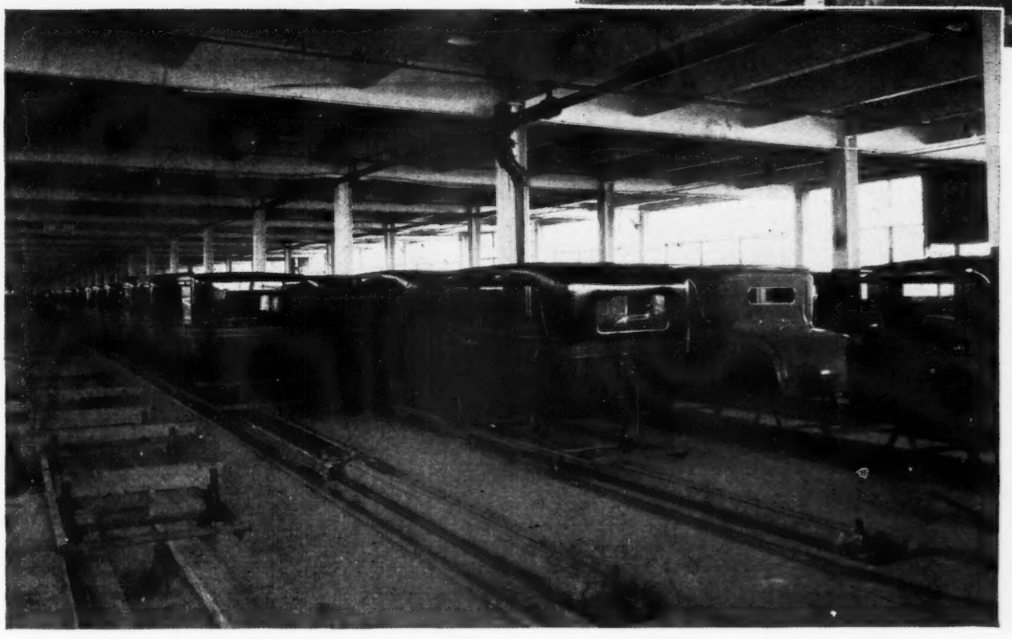
Fig. 5. Finished engines being carried on special trailers

the steel trucks shown in the left foreground. The tracks for the trucks consist of one channel member and a flat piece, the former being enough to keep the trucks on the track. The equipment shown at the very end of the tracks are pushers which, when operated, push a newly loaded truck and the whole line of trucks in front of it, one body length toward the assembly floor thus providing room for another body to be placed in position. This equipment was designed and installed by Mechanical Handling Systems, Inc.

7—*Power Boosters Used*

Fig. 7 shows a rather unusual arrangement of roller conveyors employed in the Standard plant of the American Radiator Co., for carrying radiator blocks to the machine floor. These conveyors, furnished by Matthews Conveyor Co., are equipped with power boosters and greater loads are made possible by stacking the radiators two or three deep.





Left—Fig. 6. Finished body conveyor operated by pushers

Above—Fig. 7. Conveyor systems used in radiator plant

8—*Link-Belt Ice Chain*

A conveyor system designed and built for a large body plant by Mechanical Handling Systems, Inc., is shown in Fig. 8. It is designed for carrying cushion seats between operations. A double strand Link-Belt ice chain is the conveying medium employed.

9—*Assembly Conveyor*

Fig. 9 gives another view of the new Pontiac plant. On the lower floor at the right is seen the assembly conveyor with stores of material on either side of it in bins and racks. In the middle foreground is one of the several overhead passageways connecting the mezzanine floors, on opposite sides of the main assembly bay, with an overhead conveyor operating across it. Also there can be seen several mono-rail hoists employed to lower material from the mezzanine floor directly to the main assembly line, another Mechanical Handling Systems installation.

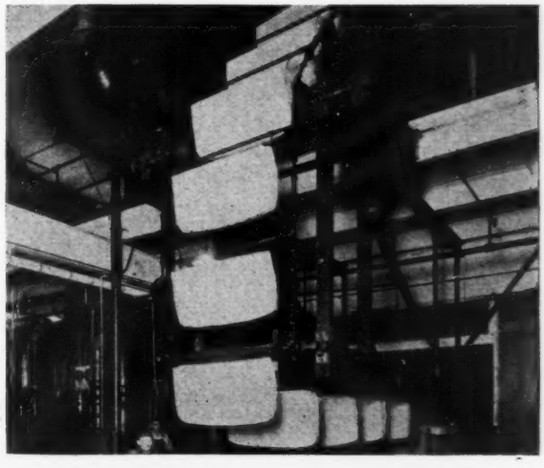
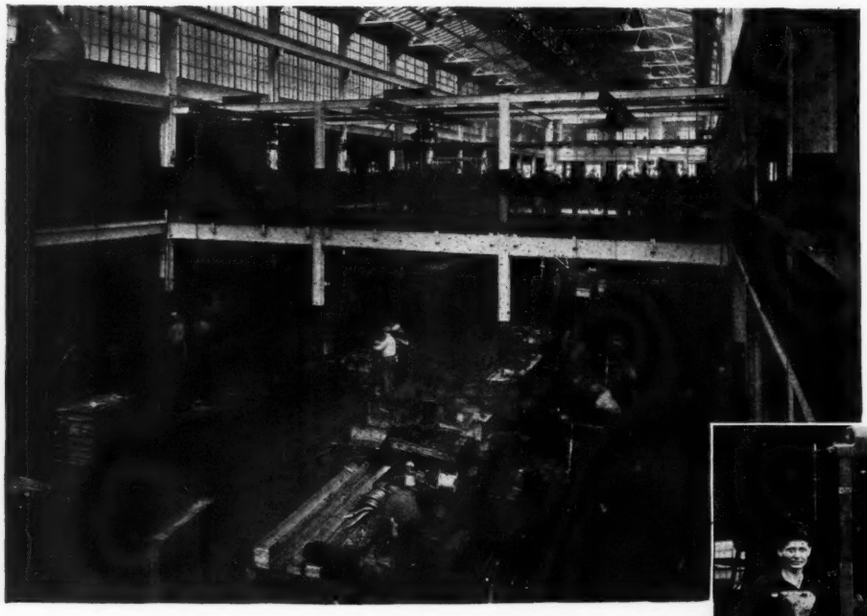
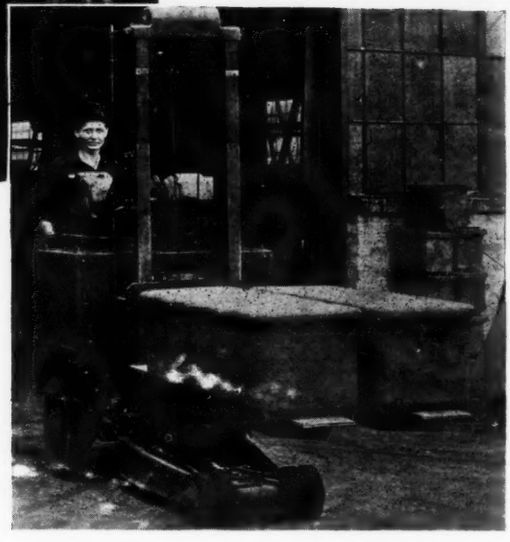


Fig. 8. Chain conveyor for transporting seat cushions



Left—Fig. 9. Many types of equipment employed in modern automobile plant

Below—Fig. 11-A. Special truck for charging case-hardening furnaces



10—*Charging Furnaces*

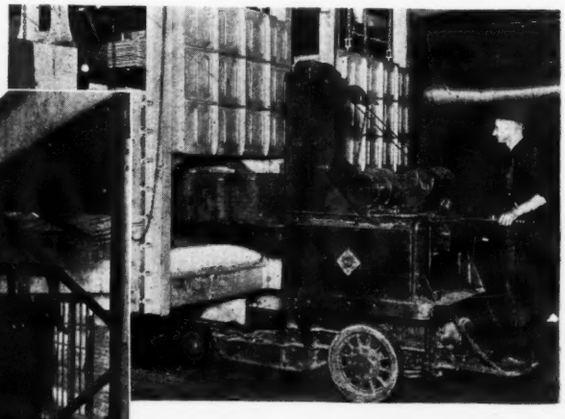
Mechanical handling equipment is particularly suitable for use in charging furnaces of various kinds. Not only can larger loads be charged at a time with greater speed but they usually afford opportunities for saving fuel because of the shorter periods the furnaces must be open to the air for loading and unloading.

The Baker charger fitted with Chisholm-Moore buckets shown in Fig. 10 typifies a service which mechanical handling equipment does very well. Two of these chargers are being used by a large automobile company for feeding cupolas. The crane is shown on the charging floor outside the foundry building where the buckets are loaded. They carry the loads through the door in front of the crane, across the charging floor and dump directly into the cupola.

11—*The Nash System*

By the use of mechanical handling equipment the Nash plant made a three-fold gain in their practice of charging case-hardening furnaces. The equipment which is now being used is shown in Figs. 11-A and 11-B. A standard Elwell-Parker high lift EL tractor had the regular platform removed and replaced by two arms of proper width and length which were bolted to the elevating mechanism. Each arm is capable of carrying five case-hardening pots each weighing about 300 lb. when fully packed.

In order to utilize fully the two arms, the furnace bottoms were changed and were provided with two recesses into which the arms could be lowered sufficiently to permit their withdrawal from the furnace after the pots had been deposited. Thus, the furnace, the arms are lowered, first setting as is shown in Fig. 12, the pots are inserted into



Left—Fig. 10. Cupola charging by means of crane truck

Above—Fig. 11-B. Method of charging case-hardening furnaces

the arms place the pots on the bed of the furnace and then drop enough farther in the recesses so that they can be withdrawn.

With this equipment a load of 3000 lb. of case-hardening pots can be charged by one operator in two or three minutes, whereas it formerly took two or three men from 20 to 25 minutes to do the same work. Not only has there been a saving in labor but less heat is lost in the charging process and production has been considerably increased.

12—*A Foundry Hoist*

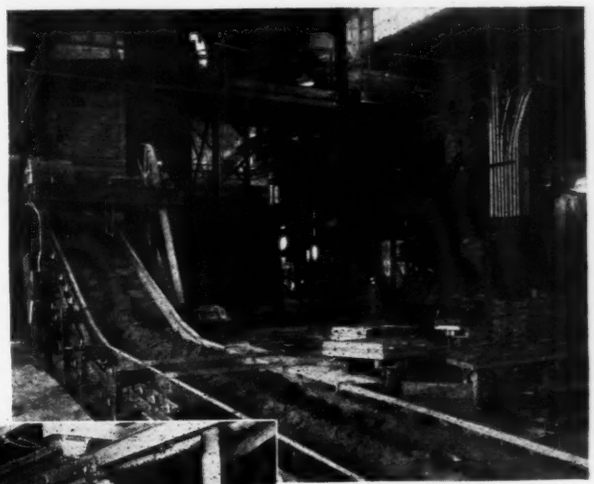
The Chisholm-Moore extended arm hoist pictured in Fig. 12 is designed particularly for use in foundries so that the operator can remain some distance away from the hot loads being carried. Mounted on a trolley, this equipment is giving good service in a Poughkeepsie automobile foundry.

13—*Specially Built Truck*

Another specially designed truck for use in heat-treating plants is shown in Fig. 13. This was built for the White plant in Cleveland by Elwell-Parker.

14—*Delivering Sand*

Fig. 14 shows the head end of a sand and casting apron conveyor 44 in. wide, which, by means of a 14 x 7 elevator, delivers sand to a hexagonal revolving screen equipped with a 24-in. feeding belt and an 18-in. double paddle mixer. The conditioned sand is then received by an 18-in. belt conveyor for final distribution. This installation was made by Link-Belt Co. for Landon Radiator Co.



Left—Fig. 12. Extended arm hoists for handling hot materials

Above—Fig. 14. Conveyor system for carrying sand through

15—*Pouring Large Molds*

For handling and pouring large molds in the Cadillac plant the equipment shown in Fig. 15 is used. Matthews roller conveyors are used to line up the molds and the pouring is made from a ladle mounted on an overhead traveling crane.

Above—Fig. 13. Special truck for use in heat-treating plants
Right—Fig. 15. Method of handling and pouring large molds

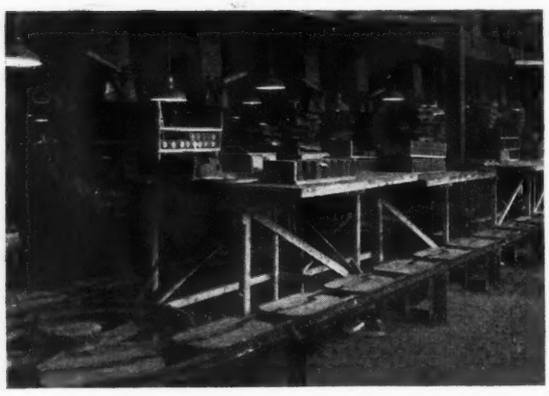


Fig. 16. Endless conveyor for molds

16—*Mold Conveyor*

Fig. 16 shows a Link-Belt conveyor employed in conveying molds for sand hoppers and gates at the malleable plant of the American Radiator Co. Note the large wheel in the left foreground about which the conveyor turns for its return trip down through the shop.

Fig. 17. Placing heavy dies in press with lift truck

17—*Changing Dies*

One of the most advantageous uses of lift trucks is in placing heavy dies in presses, the job being performed much easier and quicker, usually, than it can be done in any other way. Typical of this sort of work is the job shown in Fig. 17 where a Baker Hy-lift truck is being employed in placing a die in a press of a large body plant. Note how little effort is required on the part of the die setters in placing the die in position.

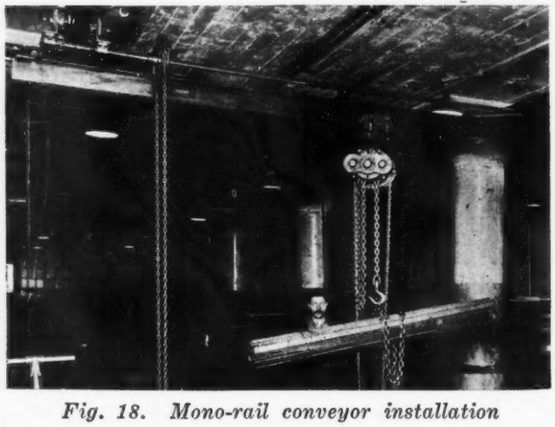


Fig. 18. Mono-rail conveyor installation

18—*Mono-Rail Installation*

Sometimes certain advantages of a short conveyor with some advantages not possessed by conveyors can be obtained by proper installations of electric hoists mounted on mono-rail trolleys as shown in Fig. 18. This installation of Chisholm-Moore equipment is in the plant of the Stewart-Warner Corp. Of particular interest is the method employed for passing the trolley rail by the pillars so that the single installation will serve the entire floor.

Fig. 19. Heavy loads carried by electric trucks

19—*Hauling Heavy Loads*

That heavy loads are no obstacle to the use of electric trucks about automobile plants is well illustrated in Fig 19 in which an Elwell-Parker truck is shown hauling a 10-ton load of pig iron in the Nash plant.

Fig. 20. Gasoline engined truck negotiates steep grades with heavy loads

20—*Gasoline Tractors*

Industrial trucks powered with gasoline engines are particularly suitable for hauling large loads up heavy grades. Fig. 20 shows a Towmotor tractor, gasoline-engine powered, hauling loads averaging from 5 to 12 tons up an 8 per cent grade in the Fisher body plant in Cleveland.

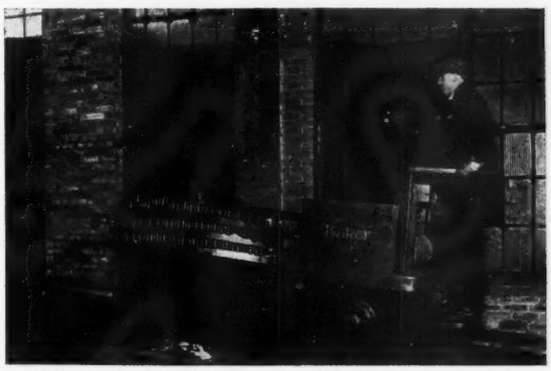


Fig. 21. Another heavy load and steep grade being worked with an electric truck

21—*Climbing Grades*

Another illustration of the way particular types of mechanical handling equipment can negotiate severe gradients with heavy loads is shown in Fig. 21. This 6300-lb. load of automobile springs is being hauled up a 12 per cent grade by a Baker 3-ton elevating truck. It would require a large number of hand truckers to handle this load on the level and the steep grade would be almost beyond their capacity.

22—*Double-Deck Conveyor*

In the Wilson Foundry & Machine Co. plant, where valve sleeves are being made, a double-deck, four-track conveyor is employed to carry the castings, to and from the machine floor. This installation, shown in Fig. 22, was furnished by Matthews.

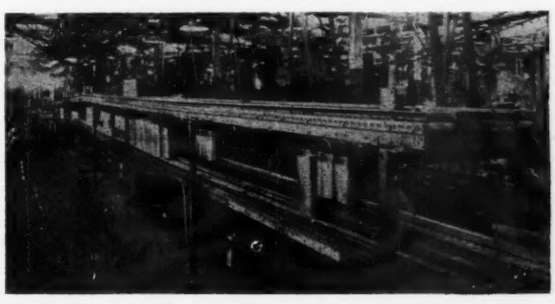


Fig. 22. Double-deck, four-track conveyor for valve sleeves

23—*Balanced Type Trailer*

. The balanced type trailer shown in Fig. 23 is particularly suitable for hauling long parts such as these stampings for automobile side rails and the Baker tractor moves the load quickly into position.

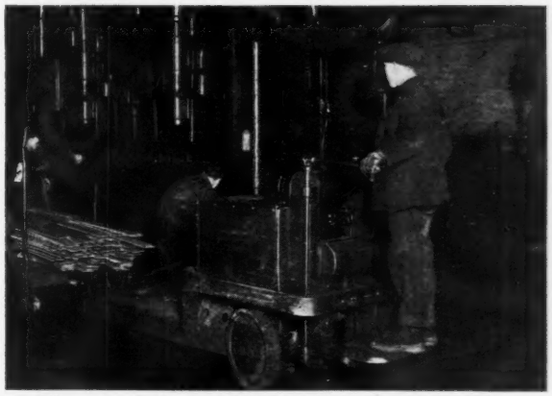


Fig. 23. Balanced type trailers for long pieces

24—*Conveyors Merged*

An interesting method of merging two roller conveyors is shown in Fig. 24 in which a number of specially designed rollers have been utilized to bring the two conveyors together. This installation was made by Matthews Conveyor Co. for the Allyne Ryan Foundry Co.

Fig. 24. How two roller conveyors can be merged

25—*Standby Equipment*

Large cranes such as the Baker equipment shown in Fig. 25 are frequently employed as standby equipment for use in case conveyors break down as well as for general service supplementary to the regular conveyor service.

Fig. 25. Large cranes used for miscellaneous work

Machine Tools *for* Automotive at *Cleveland Show*

Unusually large number of new designs exhibited—New trends revealed

AN almost unbelievable amount of development in machine tool design, most of it directly applicable to automotive manufacturing conditions, was revealed at the first exposition of the National Machine Tool Builders Association held in Cleveland, Sept. 19-23. To say that the exposition was given expressly for the benefit of the automotive production executive would be exceeding the bounds of strict accuracy, but a study of the tools exhibited and of the operations being performed on them showed a great preponderance of things automotive throughout the show.

From the moment the doors of the show first opened on Monday morning until they finally closed on Friday a constant stream of interested manufacturing men from automotive plants flowed through the aisles along with the huge river of production men from a multitude of other manufacturing industries. The vital interest of the automotive production man in learning about the latest methods of doing automotive work and the continued openness of his mind to new production ideas was evidenced clearly every day of the show. "These are no idle curiosity seekers who are thronging this exhibition," machine tool men at many booths said as the week wore on; "they are live, interested prospects for the tools that are being shown here—and a goodly proportion of them come from automotive plants of one kind or another." And these visitors not only looked and inquired; a number of them placed orders.

All in all the show was an inspiring one from both the automotive and the machine tool angle. The common character of this interest came about through the quite logical interest in automotive production which the machine tool builder is taking these days. So important has automotive demand become to the tool maker that the automotive production engineer has been in a position for some time to stipulate to a large degree the requirements which must be met by the latter.

New Trends are Found

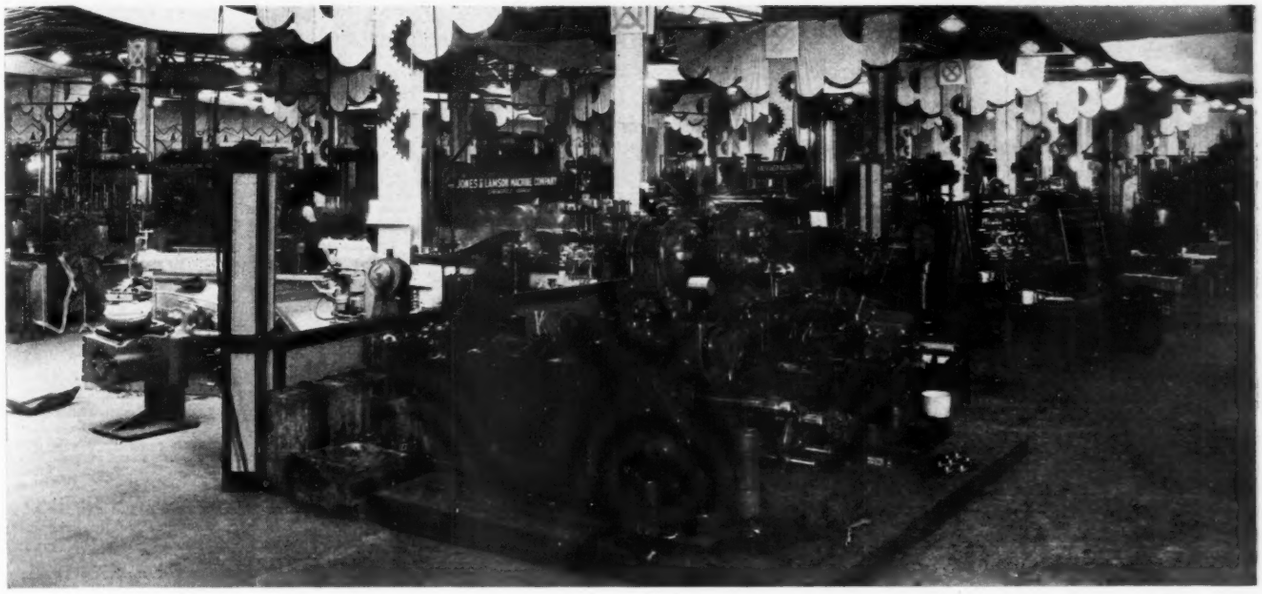
Study of the multitude of new machine tools at the show crystallizes rather clearly several definite trends in tool design as it affects automotive practice. Among the more important of these trends may be mentioned the following:

1. Increasing use of hydraulic and pneumatic power for control and operation of feeds for drill presses, tapping machines, broaches, etc.
2. Increasing use of anti-friction bearings on spindles, feed mechanisms, shafts, etc.
3. Better methods of lubricating all types of machine tools through inclosed gear-boxes, magazine oilers, etc., including belt covers and inclosures.

A view through the center of the Machine Tool Exposition

Use Predominate

By Edmund B. Neil
and
K. W. Stillman



Many tools were in operation as was the case with exhibits shown above

4. Changes in methods of holding the work when in the machine.

5. Continuance of trend toward elimination of belt drives on machines and use of shafts, gears, universals, direct mounting of motors on spindles, etc.

6. More uniform finish on all types of tools and use of standard colors, even for show machines.

This big, successful exposition developed, moreover, not only these interesting trends in tool design—which are specifically indicated in the detailed descriptions of new tools appearing on following pages—but also several pertinent aspects of machine tool and automotive production relationships. Talks with machine tool men in the booths and with automotive production men visiting the exposition brought to light a number of interesting ideas, some of them conflicting, which bear quite definitely on future trends in automotive manufacturing methods.

There are those among machine tool makers who feel that "the period of enormous expansion in practically every manufacturing line, and particularly the automotive industry, which has been witnessed in the last 15 years has passed, at least for the present." And while it is realized "that there may be extensive development and expansion in certain lines, which in turn will affect certain branches of the machine tool industry, still it is extremely doubtful that we shall see any general expansion."

A corner showing a group of important exhibits

Granting that there is something in favor of this attitude when the entire market for machine tools is included, and that the above briefly summarizes what has been said in the past relative to that industry's approach to final stabilization, just where will the production man in the future find worth while fields of activity in addition to those he now has, and what may the machine tool maker expect from them?

In the first place, numerous executives feel, there are two outstanding facts which cannot be overlooked when any mention of possible stabilization is made. First, any approach to a saturation point in automotive manufacture refers only to the production and sale of passenger cars in our domestic market, and does not include future growth in the use of motor trucks, buses, etc., nor does it wholely consider the disposal of cars through exports to foreign markets. Secondly, and what is doubly important at this time, motor vehicles now constitute but little more than one-half of the total value of the goods produced by the automotive industry, and if the present trend continues, promise to represent a still smaller proportion in the near future.

Industry is Far-Flung

For the past few years it has been repeatedly demonstrated that the automotive industry can no longer be considered merely as that comparatively limited number of companies producing completed motor vehicles. The automotive industry is far more than a few hundred vehicle manufacturers (and this does not depreciate their acknowledged importance), for it includes thousands of plants manufacturing not only the multitude of component parts sold to automotive makers, but must now cover those factories producing the accessories, equipment and supplies necessary to outfit and maintain these vehicles to the satisfaction of the ultimate consumer. To keep over 22,000,000 cars, trucks and buses in operation is no mean task, and to manufacture the accessories and equipment car owners demand for their ease, comfort and maintenance is becoming no smaller as time goes on.

Second in importance to the component parts, accessory and service equipment manufacturing fields, is another which is soon expected to command more than cursory attention—the aircraft industry. Largely an outgrowth of the automotive industry, this new industry has already shown that it has its own peculiar manufacturing problems. Yet its period of development is just beginning, and it is expected that it will pass through the same stages of economic growth and change as have befallen the motor vehicle manufacturers in the past 25 years.

When these various fields of possible expansion are brought to mind they cannot but suggest that however confident the production man may feel toward his past accomplishments and however strongly the machine tool builder believes that he has overcome production problems, there are still many outlets for their efforts in the future growth of the automotive industry. Selling and other conditions may be different, it is true, but as for the ability to absorb the output of both man and machine the future is broad and far from limited.

The many recent developments in machine tools for automotive application are well illustrated in the descriptions of new tools at the show which follow:

Improvements have been made by the Brown & Sharpe Mfg. Co., of Providence, R. I., on the high speed surface grinding attachment for use on Brown & Sharpe No. 2 surface grinding machines.

This attachment is a mechanism for driving small grinding wheels (⅜ to 1¼ in. diameter) at a high rate of speed and is readily and quickly applied to the machine. Slots and similar small surfaces whose location does not permit the use of a large diameter wheel can be rapidly and economically ground with the attachment.

Spiral bevel gears up to 10 in. pitch diameter can be cut on the new 10 in. manufacturing spiral bevel gear generator brought out by Gleason Works. The generating motion is obtained by means of a crown gear and

Gleason 10-in. spiral bevel gear generator

When Previous Machine Tool

BELOW are dates showing when products exhibited at the N. M. T. B. exposition but previously introduced were described in *Automotive Industries.* Products not announced prior to the exposition are described in the accompanying article.

Date of Issue	Company	Product
Jan. 22	Cincinnati Grinders, Inc.	Self-contained grinder.
"	U. S. Electrical Tool Co.	Line of Buffers and Polishers.
"	Barnes Drill Co.	Hydraulic cylinder hone.
"	Hoeffer Mfg. Co.	Drill Indexing table.
Jan. 29	Gleason Works	Spiral Bevel cutter and sharpener.
"	Warner & Swasey	Single and multiple cutter turners.
"	Cisco Machine Tool Co.	Automatic tapping machine.
"	Van Dorn Electric Tool Co.	Universal motored drill.
Feb. 12	Bullard Machine Co.	Spiral drive turret lathe.
"	Oilgear Co.	High speed broaching machine.
"	Warner & Swasey	Turret lathe tools.
Feb. 26	Lincoln Electric Co.	Stable arc welder.
"	Ingersoll Milling Machine Co.	Multi-spindle boring machine.
		Continuous rotary milling machine.
		52 spindle drill.
		Cyclic hydraulic boring machine.
Mar. 5	Blanchard Machine Co.	No. 12 surface grinder.
Mar. 12	Tuthill Pump Co.	Coolant pump.
"	Clipper Belt Lacer Co.	Belt lacers.
Mar. 19	Lincoln Electric Co.	Carbon arc butt welder.
"	Porter Cable Machine Co.	Combination grinder.
"	National Automatic Tool Co.	Hydraulic multi-spindle drill.
Mar. 26	Fellows Gear Shaper Co.	Side trimming gear shaper.
April 2	Gisholt Machine Co.	Static balancer.
"	Pratt & Whitney Co.	Super-micrometer.
"	Gleason Works	12 in. bevel gear generator.
"	Landis Tool Co.	Crankpin grinder.
"	Greenfield Tap & Die Corp.	No. 28 Hydroil internal grinder.
"	Brown & Sharpe Mfg. Co.	No. 30 universal worm grinder.
"	Warner & Swasey	No. 4 turret lathe.
April 23	Lincoln Electric Co.	Water cooled arc welder.
"	Porter Cable Machine Co.	Belt sanding attachment.
April 30	Landis Machine Co.	Style M collapsible tap.
"	Blanchard Machine Co.	Demagnetizer.
		Hand reamer.
"	Lincoln Electric Co.	Stable arc welder.

Descriptions Were Published

Date of Issue	Company	Product
May 14	Greenfield Tap & Die Corp.	No. 28-c Hydroll grinder.
		Rapid inspection gage.
May 28	Landis Tool Co.	No. 11 and 12 grinder changes
"	Foote-Burt Co.	Motor mounting for drills.
"	Van Dorn Electric Tool Co.	Heavy duty drill.
June 18	Hisey Wolf Machine Co.	Universal drill.
July 2	Rockford Drilling Machine Co.	Combination boring machine.
"	Blanchard Machine Co.	No. 16 A surface grinder.
"	Lincoln Electric Co.	Electrode holder.
"	Landis Tool Co.	Line of universal grinders.
"	Barnes Drill Co.	Gang drill.
July 16	Link Belt Co.	Belt conveyor idler.
July 23	Badger Tool Co.	Spring eye grinder.
"	Consolidated Machine Tool Co.	Newton rise and fall milling machine.
July 30	Brown & Sharpe Mfg. Co.	Tool grinding equipment.
		Micrometer.
"	Foote-Burt Co.	Multiple spindle drill.
Aug. 13	Cincinnati Shaper Co.	Power rapid traverse shaper.
"	General Electric	Atomic hydrogen welder.
"	Gallmeyer & Livingston	No. 1½ cutter and tool grinder.
Aug. 20	Kearney & Trecker Corp.	No. 2 and 3 milling machines.
"	Landis Machine Co.	Geist pipe cutter.
Aug. 27	Fosdick Machine Tool Co.	6 ft. radial drill.
"	Brown & Sharpe Mfg. Co.	Wheel truing attachment.
"	Blanchard Machine Co.	36 in. magnetic chuck.
"	Heald Machine Co.	Sizematic duplex internal grinder.
		No. 25A grinder.
Sept. 3	Norton Co.	Type BA heavy duty grinder.
"	Reed-Prentice Corp.	14 in. sliding geared head lathe.
"	Foote-Burt Co.	Broaching machine.
"	Norton Co.	4 x 5 in. Type B grinder.
"	Landis Tool Co.	Hydraulic grinder.
"	Link Belt Co.	Speed reducing unit.
"	Gallmeyer & Livingston	Oilgear grinder.
"	Cincinnati Grinders, Inc.	Brake drum grinder.
"	National Automatic Tool Co.	4 in. hydraulic drill.
"	Osterlein Machine Co.	48 in. offset miller.
Sept. 10	Norton Co.	Cam grinding attachment.
"	Heald Machine Co.	Style 72-A2 internal grinder.
Sept. 17	Racine Tool & Machine Co.	Shear cut saw.
"	Kearney & Trecker	Mil-Waukee-Mil miller.
"	Geometric Tool Co.	Style KH die heads.
"	Bullard Machine Co.	Contin-u-matic center lathe.
Sept. 24	Bullard Machine Co.	Auto-Matic vertical turret lathe.
"	Gould & Eberhardt	Manufacturing shaper.

segment. The unit carrying the cutter is mounted on an upright and has a lateral movement to clear the cutter while the blank is indexing.

Three motors are used to eliminate many moving parts. One motor furnishes the cutter drive, the second produces the feed and generating motion while a third operates the index. The index is of the worm and gear type which permits the use of change gears where it is required to index for different numbers of teeth. An automatic stop is provided to stop the machine when the gear cutting is completed so that one operator can handle several machines.

Automatic lubrication is employed all over except for a few easily accessible hand oilers. The oil passes through a filter and two oil sights. Chips drop into a basket which, when full, is emptied into a second basket which can be removed from the rear while the machine is in operation. The machine is designed for work heads for gears of greater pitch angles than 63 deg. 26 min., and for pinions of pitch angles less than 26 deg. 34 min.

Cutters and Arbors Extra

Standard equipment includes a segment for one gear or one pinion only but a variety of gears can be arranged for at the time of building. Cutters and arbors are extra equipment. The three motors and controllers for them are standard. The machine cannot be arranged for belt drive.

The Fellows Gear Shaper Co., Springfield, Vt., has recently placed on the market a new high-speed gear shaper having a 2-in. stroke, and designed for cutting gears up to end including 5/7 diametral pitch.

This machine has a hollow-type cutter-spindle made in one piece which is well supported in the saddle and is arranged to carry 4-in. pitch diameter cutters only having a 1¾-in. hole.

The entire driving mechanism of the machine has been strengthened, the driving pulleys are 15 instead of 10 in. in diameter, and also of wider face than those used on the regular No. 7 type high-speed gear shaper. Connecting rod, operating arm, etc., are increased in strength, and a new apron has been added. In addition to the advantages of a longer stroke, this machine is better adapted to heavy-duty work, and will cut gears up to 2 in. face, 7 in. pitch diameter, and 5/7 diametral pitch.

Helical Milling Cutters

The Brown & Sharpe Mfg. Co. has found it advantageous to use helical instead of the regular milling cutters. The use of these cutters not only increased production but in many instances they made it possible to eliminate entire operations. In some instances one machine with these cutters turned out as much work as was previously done with two. A good example of the saving effected by the use of helical mills is the milling of form tool blanks. These blanks are made of tool steel, and with the helical mills twice as many were finished per hour as were formerly finished with the regular milling cutters. A machine formerly turned out 100 pieces per hour. The rate, was jumped up to 200 pieces per hour and the cutter removed the metal at the rate of 3¼ cu. in. per minute.

Another instance of the saving effected by the use of helical mills was found in the milling of table gibs. These parts were formerly rough-milled and then planed down to size, because a very smooth finish was necessary. With the helical mills it was found that the size of the cut could be increased, obtaining at the same time the desired finish, thus eliminating the long and rather expensive operation of planing. There was a substantial decrease in the cost per piece of these parts as well as a decided increase in their production.

The Cincinnati Milling Machine Co. has brought out two giant automatics equipped with hydromatic—automatically controlled hydraulic—feed in plain and duplex types. They are available in six sizes ranging

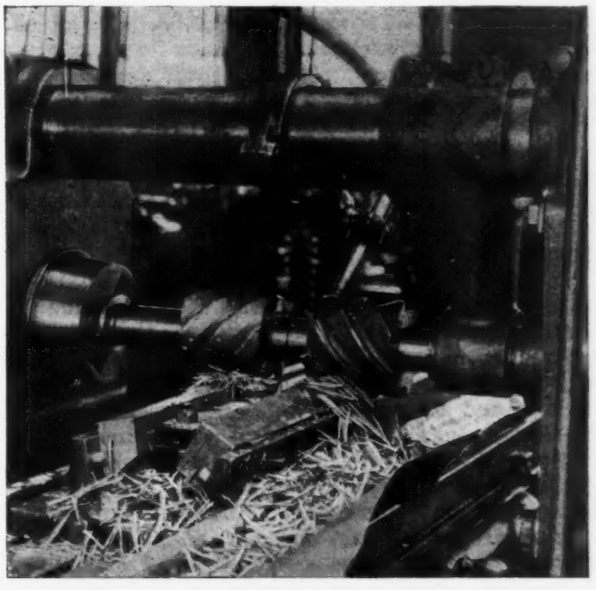
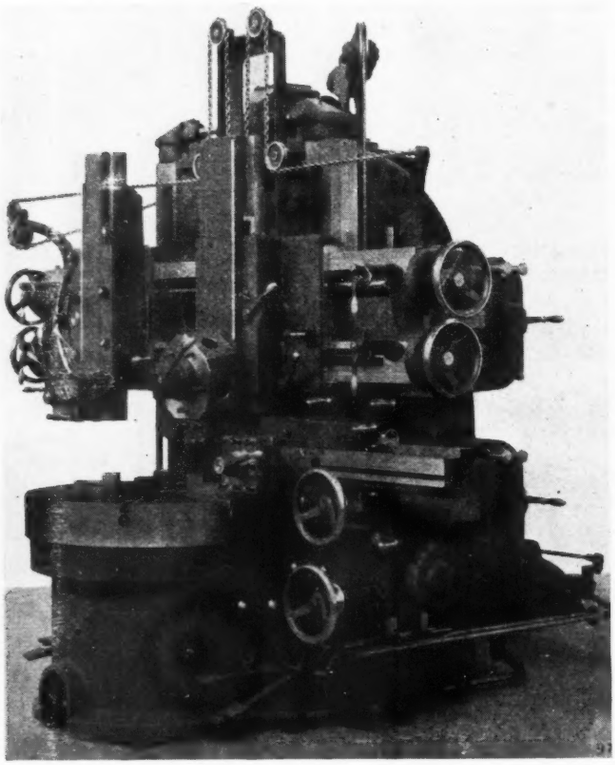


Table gibs for milling machines being milled with Brown & Sharpe helical milling cutters

from 10 to 15 hp. and from 36 to 72 in. cutting range.

With the hydromatic feed any feed cycle can be obtained, such as intermittent, reciprocating, accelerating, retarding or stop and dwell.

The No. 66 metal sawing machine is a recent product of Cochrane-Bly Co., Rochester, N. Y. The drive is



King side head boring and turning mill

through a friction clutch and hardened nickel steel gears all inclosed and running in oil. The feed screw is mounted in line with the center of the arbor and close to the saw blade. Starting and stopping, of the machine; start, stop and reverse of feed and adjustment of the carriage to or from work are controlled from either front or rear.

The Universal Boring Machine Co., Hudson, Mass., displayed its No. 24 Tri-way horizontal boring machine. The bed is provided with three flat ways for supporting the carriage and rear post base. Brief specifications include: 20 in. automatic travel of main boring bar; 36 in. resetting travel of bar; 32 in. power cross feed of table; 24 in. power longitudinal feed to carriage; 20 in. power vertical feed to head; 12 spindle speeds ranging from 16 to 650 r.p.m.; 9 feeds in either direction, with milling feeds ranging from 1 to 12 in. and boring feeds from .03 to 4.8 in. per min.

The Barber-Colman Co., Rockford, Ill., has developed a new reamer sharpening machine which is designed to entirely eliminate hand operations and to turn out reamers which are identical one with another. By means of a small grinding wheel mounted on a moveable head and a work table whose movements may be controlled by various shaped cams, the machine can be set to hold within the closest limits all the dimensions necessary to obtaining a proper reamer. These include the two cutting clearance angles, the taper at the nose of the reamer, the chamfer ahead of the tapered section and where necessary a relief or back taper behind the point where actual reaming is done. All of these dimensions are held to close dimensions and the entire process is completed mechanically at one setting of the machine.

In the new automatic screw machine recently developed by Greenlee Bros. & Co., Rockford, Ill., the tool slide is operated through rack and intermittent gearing to reduce set up time by elimination of the usual cam changes. All cross slides are operated by individual cams permitting individual feed to each. An indexing mechanism which speeds up the cycle is provided. Indexing and stock feed takes place between the fourth and first positions leaving the fourth position available for end working operations such as threading, etc., in addition to cutting off.

Anti-friction bearings are provided throughout. The spindles are mounted in Timkens. Automatic lubrication is provided for all working parts while a self-contained coolant system is furnished. Other features of this new machine are: heavy, one-piece head; spindle drive gears placed between spindle bearings; feed tube guard to prevent feed tube working out; safety clutch for the feed shaft; collet spool guards to prevent collets from opening while the machine is in motion; end working tools can be used in any position; threading can be performed in the third or fourth operations.

HS Grinding Machines

Ransom Mfg. Co., Oshkosh, Wis., has brought out a line of HS type grinding machines. They are designed with rigidity to operate any high speed wheels up to 11,000 surface ft. per min. Large SKF bearings and spindles are used. An oil filter is provided to protect against abrasives. The rests and rest brackets are removable while the front hopper is removable to permit the workman to stand close to the wheel. Push button control can be provided. Four machines each are furnished for direct and alternating current, ranging, in straight side wheel sizes, from 14 x 3 x 8 in. to 24 x 3 x 8 in.

Reed-Prentice Corp., Worcester, Mass., has brought out Model 6 Becker die sinking and vertical milling machine. This machine has a longitudinal power feed range of 72 in. and cross-feed of 24 in., while the travel of the head on the column is 18½ in. Rapid power traverse in either direction is provided both longitudinally and crosswise at a speed of 95 in. per min. Working surface of the table is 72 x 20 in.

Spindle speed ranges from 15 to 500 r.p.m. and are 12 in number. There are eight feeds for each spindle speed providing a range from .002 to .280 in.

Pratt & Whitney Co. has placed a No. 1 jig borer on the market which is similar to its No. 2 machine but designed for small work. It has been built for hard service and is suitable for the finest of small precision boring. It is equipped with a four-speed motor and a set of back gears to give eight spindle speeds ranging up to 1800 r.p.m. Screws are used for table movement but all measurements are controlled by end measures, inside micrometers and built-in indicator dials. Complete tool equipment including a rotary indexing table is available.

The W. & S. 3-A turret lathe is the latest product of The Warner & Swasey Co. This machine has a capacity of 18 in. chuck, 18¼ in. swing over the carriage, 24½ in. swing over the bed and 9¼ in. cross travel of the hexagon turret.

Alloy hardened steel gears are used exclusively in the head. Twelve spindle speeds are provided. Gear shafts run in Timken bearings. Forward and reverse speed changes are obtained through friction change clutches, all other speeds through sliding gears. The

cross slide carriage has 16 longitudinal and cross feeds forward or reverse, which are automatically disengaged by stops. This gives a wide range of feeds for combination cuts. Accuracy is gaged by a large micrometer dial. The cross slide will clear the chuck and when not in use may be moved out of the way of the hexagon turret. The square turret is easily indexed and is clamped securely by a patented taper binding mechanism.

In the hexagonal cross sliding turret there are also 16 right and left-hand longitudinal feeds and 16 cross feeds. A rapid traverse is also provided for the hexagonal turret carriage.

The Monarch Machine Tool Co., Sidney, Ohio, has developed an automatic lathe with double carriage. Brief specifications of this new machine are: Swing over carriage 15 in.; over facing slide 12 in.; over bed 16½ in.; between centers 6 ft. bed, 22 in.; maximum travel of facing slide 3½ in.; maximum length will turn 7 in.; spindle speeds and feeds selective; Timken bearings; weight 7000 lb.; 15 hp. motor.

A new Brown & Sharpe machine displayed at the show was an automatic high-speed screw threading machine. This has been designed to meet the requirements of producing large quantities of small screws and similar threaded parts from brass or steel. In general the machine is similar to other Brown & Sharpe screw machines except that in the new one there is a horizontal spindle carrying a die which is mounted in line with and opposed to the work spindle. Both spindles run in the same direction but at different speeds, the difference permitting the die to run on at the required surface speed after it has been fed into position by a cam. A tripping mechanism provides an exceptionally accurate control for the length of the stock threaded and is accomplished by stopping the die instantly when the part is threaded to the required length.

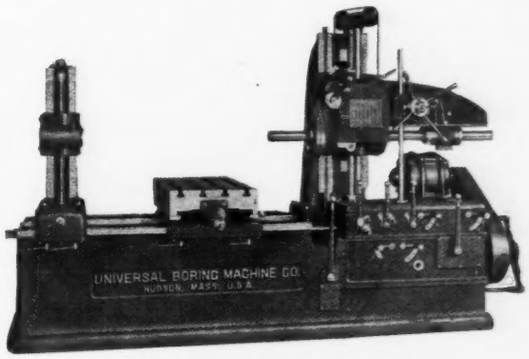
18 Spindle Speeds

There are 18 spindle speeds ranging from 875 to 5000 r.p.m. while the die spindle also has 18 speed changes ranging from 1094 to 7000 r.p.m.

A new product of The King Machine Tool Co., Cincinnati, is a 42-in. side head boring and turning mill. This machine is provided with 16 table speeds ranging from 3 to 90 r.p.m., and 12 feeds ranging from 1/96 to ½ in. per revolution of the table. The speed of the rapid traverse is 10 ft. per min. The diameter of the table is 40 in.

The Red Liner is the name given to a new device developed by The Fellows Gear Shaper Co., for automatic inspection of gears. It comprises two studs, one fixed and the other movable. The movable stud carries a master gear of known properties while the gear to be tested is placed on the fixed stud. The machine is based on the principle of changes in center distance being effected by errors in profile, tooth spacing and eccentricity. These inaccuracies impart a movement to the movable stud which, in turn, transmits movement to a charting pen which traces the record on ruled paper which is unwound from a roll and advances at a fixed rate past the point of the pen.

A shear cut metal saw is a new product of Racine



Universal No. 24 Tri-way horizontal boring machine

Tool & Machine Co., Racine, Wis. It used a positive screw feed, each successive cut with the same blade being made in exactly the same time. A feed range from less than 1/1000 in. to more than 25/1000 in. per stroke is obtained through manipulation of a single lever.

William Sellers & Co., Inc., Philadelphia, have brought out a new drill grinder designated as the 2-A. It has been designed to produce the correct shape in every size of twist or flat drill throughout the range of the machine. Clearance is provided to insure free cutting and is automatically regulated for various sizes of drills. The machine is automatic in operation and after being once set to provide the desired angle will grind any number of drills of various sizes, automatically compensating for variations in diameter.

The National Acme Co., Cleveland, has brought out a new 9/16-2⅝-in. series of Gridley automatic mutiple spindle screw machines known as Model G. The general construction is the same as in former models. The four-spindles are held in the spindle center which revolves on wide bearings while the tool slide is carried on the extended center of the spindle carrier.

Cutting tools work from two cross slides and from four positions on the tool slides, the latter being so designed that the tool holders may be mounted one behind the other to perform two or more operations at each position. By using double deck tool holders, roughing and finishing cuts may be made with one advance of the slides. Standard shaving tools may be applied after the regular forming operations.

This model is available in seven sizes: 9/16, ⅞, 1¼, 1⅜, 1¾, 2⅝ and 2⅞ in.

Barnes Drill Co., Rockford, Ill., has developed a new self-oiling, all-geared, all-ball-bearing drill with hydraulic control which is known as the Model 240. The hydraulic pressure feed employed is similar to that used on Barnes cylinder hones except that it does not reciprocate but furnishes a constant pressure feed.

Fairbanks, Morse & Co., Chicago, displayed a new inclosed, ventilated electric motor designed for use in dusty and dirty locations. This motor is equipped with baffle plates arranged about the ventilating fan in such a manner that any dirt drawn in with the air is thrown

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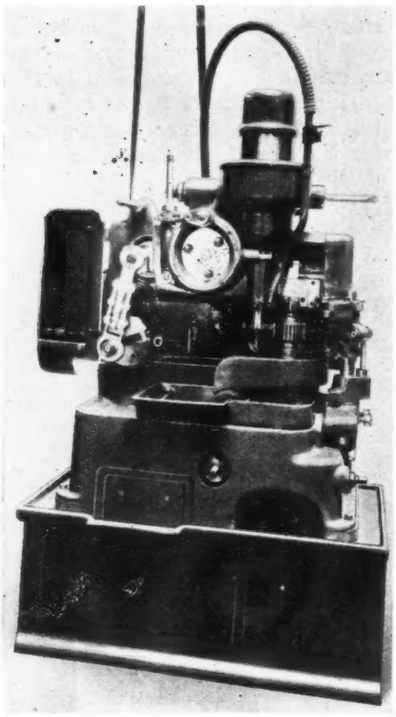
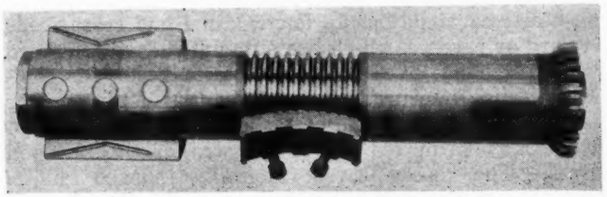
MORE than 11,000 persons visited the National Machine Tool Builders' Association exposition in Cleveland last week, James E. Gleason, of Rochester, president, estimated.

Executives will meet in Lenox, Mass., Oct. 11, to determine where the next exposition will be held, and the success of the show in Cleveland may take it back there again in 1928.



Left—Fellows high-speed gear shaper No. 7-A. Guard is shown opened to expose heavier operating arm and connecting rod



Right—Detail of the Fellows cutter spindle

out again by centrifugal force before reaching the windings.

The Hendey Machine Co., Torrington, Conn., is showing a new 12-speed geared-head lathe equipped with beds ranging from 6 to 20 ft. long, and designed to swing 20 in. over the shears. Twelve spindle speeds are available ranging from 7.8 r.p.m. to 373 r.p.m. Thirty-six feeds are supplied ranging from 12 to 672 spindle rotations per inch and the same number of threads from 1 to 56 per inch are available.

Automatic Crankshaft Lathe

A center drive, automatic crankshaft lathe designed for forming the stub and flange end-bearings of crankshafts simultaneously has been developed by R. K. LeBlond Machine Tool Co., Cincinnati. It can also be used for forming the ends of rear axles and other work in which both ends must be formed. The work is held in a central driving head. The center drive can be supplied with two or single bearing support. The drive from headstock to center head is by overhead shaft. The revolving member of the center head runs in two bronze bearings which are well lubricated and replaceable. Forming tools are carried on four toolblocks and are fed toward the center by means of profile plates. Rapid power traverse is automatically controlled.

The Badger Tool Co., Beloit, Wis., is showing its No. 8 face-grinding machine equipped with hydraulically operated table. The latter consists of a compound slide fitted to the knee of the base casting and a reciprocating table top fastened to the top of the slide. Speed of travel of the table top can be controlled while it is in any position, whether grinding or not. Besides permitting selection of proper grinding speeds it is claimed that this speed regulation produces greater production.

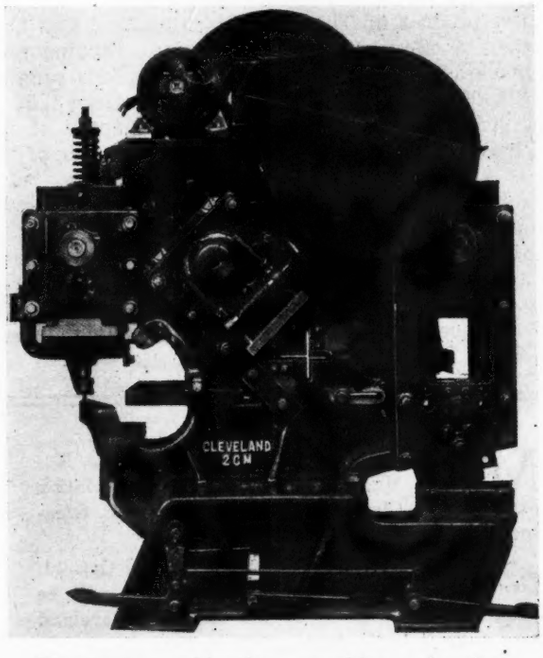
Baker Bros., Inc., Toledo, Ohio, has a No. 25H hydraulic feed, boring and drilling machine with five-spindle head and six-station table. The spindles are driven by direct motor drive while the feed mechanism is an Oilgear type. It is also furnished as a single-spindle machine, while on the mutiple-spindle types vertical adjustments are provided for each spindle. Rate of feed for setting operations is variable.

The new Bryant No. 12 semi-automatic hole grinder has a 12-in. swing and an 8-in. grinding stroke and is self-contained. Its general construction is similar to the smaller No. 3 machine made by the Bryant Chucking Grinder Co., Springfield, Vt. A 4-hp. motor provides power for the wheel while a 2-hp. motor is used for traversing the work table. An automatic clutch starts and stops the work as the wheel enters or leaves. Provision is made for the use of sizing devices.

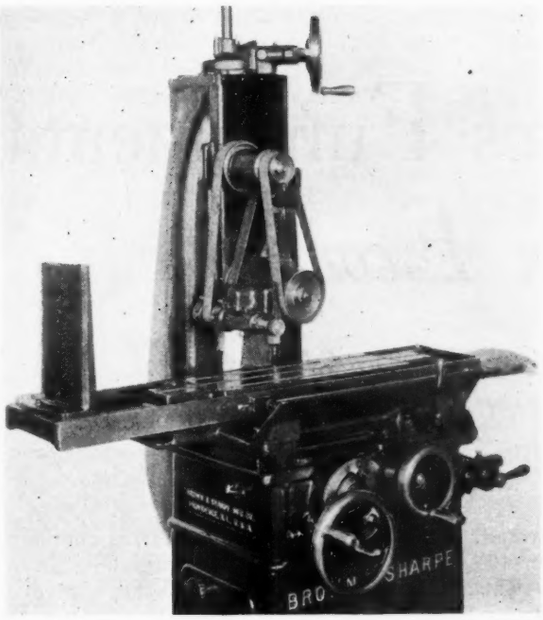
A one-speed, one-feed, single-purpose machine designed to meet specific requirements has been developed by The Cincinnati-Bickford Tool Co., in its new Super-Service production drill. It has none of the features usually found on general purpose machines but by merely transposing gears 16 feeds and speeds can be obtained. Sixteen gear combinations provide a range of speeds from 263 to 1233 r.p.m., while feeds range from .0004 to .025 in. The spindle runs in roller bearings. The table is bolted to the face of the column and is surrounded by a wide groove of great chip capacity.

The Moline Tool Co., Moline, Ill., has added the No. 115-D Hole-Hog driller which has been designed especially for work on valve parts. The cycle of operations is automatic and the proper setting of stops automatically shifts the operating lever to slow feed and reverse after the work has been completed. The minimum center distance to be obtained is 2 in. and the maximum 40 in. The rail travel is 24 in.

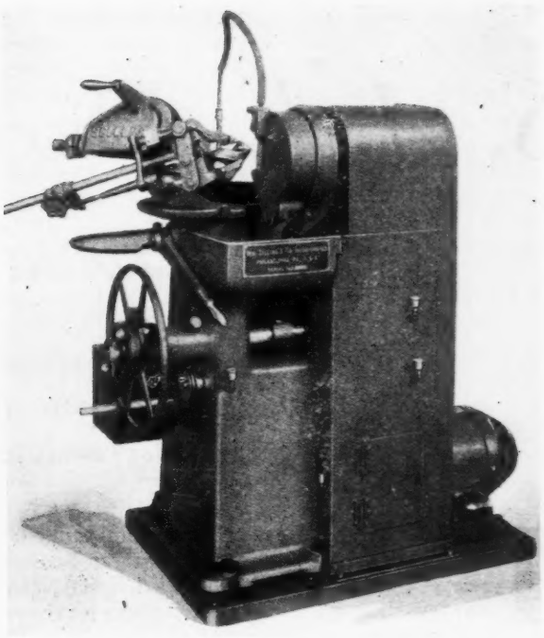
The new No. 89 hydraulic surface grinder of the Gardner Machine Co. has been designed to handle a wide variety of work and is particularly suitable for



Cleveland combination punching, shearing, coping, notching and twisting machine



Brown & Sharpe No. 2 grinder



Sellers drill grinding machine

handling pieces having two or more surfaces to be ground but which cannot be economically finished simultaneously.

It has two hydraulically operated tables and a single head supporting two grinding wheels. It is semi-automatic so that one operator can serve both work tables, which can be operated simultaneously or alternately. All table movements can be predetermined and, after being set, are controlled by a lever. The surfaces being ground are easily visible to the operator.

The new Gisholt 2L heavy-duty turret lathe has been designed for work up to ¾ x 40 in. bar, 16-in. chuck with 18-in. swing. It has the standard Gisholt two-carriage equipment with the addition of a cross-feeding square turret. Special features in the new machine are a cross slide rapid traverse and hardened steel ways.

Sixteen feeds are provided, ranging from .004 to .168 in. longitudinal and from .002 to .084 in. lateral. There are 12 spindle speeds and reverse. Other features include hardened steel geared head; single pulley drive; mutiple disk elutches; square lock construction; full-swing side carriage; self-indexing square turret; rapid traverse to cross slide, side carriage and turret carriage; cross feeding or fixed center turret; independent feed changes for either carriage; Madison-Kipp oiling system to traverse parts and feed train.

A new product of The Cleveland Punch & Shear Works Co. is a combination punching, shearing, coping, notching and twisting machine. This machine has capacity for punching I-beams 4 to 15 in. in flange and web; columns from 4 to 8 in. in flange and web; plates up to 1 1/16 in.; holes in ⅝ in. material. For notching it has a capacity for I-beams of 6 in., channels up to 8 in. and 2 x 2 x ¼ in. angles. It will shear 4 x 4 x ½ in. angles straight off, 6 in. I-beams and 9 in. channels.

All operations of the machine are separately controlled. The punching end is equipped with a Cleveland full-floating punching attachment. All clutches run in oil and are positively controlled. The sheared material falls clear of the machine.

The Foote-Burt Co., Cleveland, has developed an automatic tapping machine for use on nuts and similar parts having straight through threads. This is a single spindle, horizontal type and is entirely automatic except for keeping the magazine loaded.

High production speed is possible because it is not necessary to reverse the tap after finishing each nut. While one nut is being tapped another is being started and the tapped piece is carried back onto the shank of the tap to be stripped off at the end of each cycle of operation.

Sundstrand Machine Tool Co., Rockford, Ill., has developed a 15-in. automatic designed specifically for production work on many typical automotive parts. Through lack of space here a complete description of this interesting machine will be postponed until a later issue.

The Acme Machine Tool Co., Cincinnati, displayed a full universal turret lathe having duo control, 4½ in. bar capacity, 17-in. chuck capacity and with swing over the bed of 25 in. The all-geared head is driven by a single pulley with all speed and direction changes being made through two levers. Transmission shafts run in Timken bearings and a ball thrust bearing is provided for the spindle. Splash lubrication provides filtered oil to all bearings.

The motor drive is in the head end leg and each apron contains a separate feed mechanism. Spindle speeds are nine in number and range from 8 to 266 r.p.m., while there are 12 power feeds in each apron ranging from .005 to .200 in. per revolution.

A new power scraper has been developed by Anderson Bros. Mfg. Co., Rockford, Ill., which, while being as easily controlled as a hand scraper has much more power and endurance available for production work than has an unassisted operator. The scraper ram is operated through a rack and gear mechanism by a ¼ hp. motor equipped with a circuit breaker for overload protection. The ram travels forward in the cutting stroke at the rate of 60 ft. per minute and returns at 90. Length of stroke is adjustable instantaneously at the will of the operator from a fraction of an inch to the full stroke of the ram. The machine is portable, being equipped with an elevating truck which lifts the base from the floor for moving about.

S. A. E. Discusses Fundamentals of Production Economy

Papers presented at sessions in Cleveland and Detroit deal with details of important manufacturing processes. "Integrated production" suggested.

THOROUGH discussions of the fundamental economics surrounding automotive production development vied with detailed descriptions of a few important manufacturing processes at the annual production meeting of the Society of Automotive Engineers held in Cleveland and Detroit last week, Sept. 19-22.

Headed by E. P. Blanchard's paper entitled "Integrated Production," in which he outlined a theory of manufacturing economics involving several unique aspects, and including talks on net profits from modern machine tools, production control, production engineering, relation of time study to management and others, a multitude of important economic phases underlying modern production methods were fully aired. Among the more specific production topics to get attention were those involving airplane engine manufacture, application of electric motors to machine tools, cylinder and other types of grinding, relation of metallurgy to production, and similar questions which are occupying the minds of automotive men at this time.

Sessions in Two Cities

The first two days of the four-day session were spent in Cleveland and the last two in Detroit. Actual attendance at the sessions was not large, but a very considerable interest in the topics discussed was evinced.

Digests of the various papers presented—which appear on following pages—reveal in considerable detail the lines along which many production executives are thinking.

The opening session Monday morning, presided over by E. P. Blanchard, Bullard Machine Tool Co., was devoted almost entirely to discussion of the economic side of machine tool installations. George T. Trundle, Jr., Trundle Engineering Corp., in his paper on net profit from machine tools, gave three reasons why, in spite of the very remarkable influence modern tools have had upon operating economics, many manufacturers still are slow in replacing obsolete, inefficient machines with those of modern design.

First is the mental inertia, natural to most people, which opposes, to some extent, changes of any nature, and this condition is further aggravated by the fact that many machine tools, while obsolete in comparison with others now available, are still in good mechanical condition and are capable of turning out a fair quantity of work.

The second reason is that manufacturers demand abnormally great operating economies from contemplated new tools, such as requiring that they be able to pay for themselves within a year or some period much shorter than the probably useful life of the machine. With this is coupled the difficulty, under present conditions, of accurate predetermination of just what savings can be made through the installation of a new tool.

The third reason for delay in machine tool replacement is the lack of ready cash to make purchases otherwise proved desirable. Through manipulation of finances, reserves set aside for depreciation of tools, which should be available for the purchase of replacements, are frequently used for other purposes so that while the production department has been charged for depreciation it cannot benefit by it.

Eugene Bouton, of Chandler, emphasized the point that depreciation reserves are the property of the production department, so that whether they have been used in plant extensions or what not, provision should be made that they will be available to the production department whenever desired for new purchases.

It seemed to be the consensus that it was mostly a matter of bookkeeping, one speaker suggesting that depreciation reserves are often used in dull times to cover operating deficits so that a net profit can be shown. Mr. Trundle pointed out that any plan is wrong in which depreciation reserves are employed for anything but keeping the tool equipment in first class condition.

He even questioned the common practice of estimating operating economies of new tools in relation to their full purchase price but suggested that this be done in relation only to that part of the purchase price in excess of the reserve set up against the tool being replaced, plus its scrap or resale value, since that amount is actually the only new investment the purchaser is making.

Standardized Method Needed

In regard to the predetermination of the operating economies of a new tool, a need was expressed for some standardized method. Mr. Blanchard said that even unbiased analyses of operations made by competent engineers are often questioned by prospective customers, not as to facts adduced but rather as to the method of obtaining the facts. A standardized method for obtaining such information would, it was thought, go a long way toward dispelling the doubts many prospective machine tool buyers now seem to have of the ability of the new tools to meet their requirements economically.

The second paper of the session was on the manufacturing methods used in producing the Wright Whirlwind engine. It was prepared by Lee M. Beatty, Wright Aeronautical Corp., and, in his absence, was read by A. R. Fors, Continental Motor Corp.

It was a very detailed description of production methods used at the Wright plant including tooling, inspection and other items of interest. Because of its undoubted value to other members of the industry the paper will be given in an early issue of *Automotive Industries* in more detail than space requirements permit here.

The Use of Abrasives

Finishing automotive work by the use of abrasives was the general subject of the session over which K. H. Condit, editor, *American Machinist*, presided and three papers on honing, cylinder grinding, and the manufacture of abrasive stones aroused considerable interest.

The first paper on this subject was given by L. A. Becker of A. P. Schrauer & Co., and dealt with the development of a crankshaft honing device by the use of which all main and crankpin bearings are given a surface equivalent or superior to that obtained after many hundred miles of operation in the car. In other words, the initial wear left in the bearings because of the imperfect surface resulting from ordinary grinding operations is removed by honing.

The influence that such a process has on the initial operating efficiency of the engine was suggested by Mr. Becker in reply to a question. As an experiment, an engine was completely finished according to their methods. The crankshaft was honed as were the cylinders, the pistons and the piston pins and the connecting rod bearings were broached.

After being placed on a test stand and run at high speed for a long period the engine was disassembled and no appreciable wear could be detected on any of the finished surfaces. In addition, the output of this engine was 6 per cent greater than an identical engine with unhoned surfaces and the friction horsepower was reduced from 4 to 3. Mr. Becker's paper, in part, is given later.

Mr. Page, chief engineer, Hutto Engineering Co., read a paper on developments in cylinder grinding which had been prepared by M. C. Hutto of that company. By the use of charts he outlined the many steps in the development of the Hutto grinder which has been described in detail in *Automotive Industries.*

In reply to questions asked at the conclusion of the paper, Mr. Page said that the average cost for stones was two or three cents for six holes; that some success had been obtained with the Hutto grinder working on steel and semi-steel cylinders but that work with bronze was still in the experimental stage; and that, contrary to the condition prevailing in honing work outlined by Mr. Becker in which kerosene plus a maximum of 25 per cent lard oil was best for flushing the work, with cylinder grinding straight kerosene had proved to be most satisfactory.

Reciprocation of the abrasives as well as rotation was pointed out as being very important, mainly for keeping the stones free from grit. Recommended speeds were given by Mr. Page as not exceeding 300 r.p.m. or an average of about 200 surface feet per minute and from 70 to 100 reciprocations per minute.

Following Mr. Page, P. H. Walker of the Carborundum Co., described manufacturing methods for abrasive stones such as are used in the Hutto grinder.

The particular conditions met with in this sort of work in which relatively slow speed, high unit pressure and constant contact with the work obtains, also has added to the difficulties of producing satisfactory stones. At present they are cast in molds about 4 x 11 in., the abrasive grains first having been coated evenly and thoroughly with the bonding material.

A recent development which has greatly aided in the production of good stones is a tamping machine used to provide a uniform structure of material after it has been poured in the mold but before it is pressed hydraulically.

This equipment is provided with a number of small tamping rods.

A digest of Mr. Becker's paper on crankshaft honing methods follows:

Honing of Cylinders Produces Perfect Job

AS surely as grinding improves turning, honing improves grinding. Grinding produces a more nearly perfect cylinder than turning, and honing, after grinding will produce a cylinder near to absolute perfection.

That a surface which has been ground is unfit as a bearing is well known, for every manufacturer and every user of crankshafts has endeavored to improve the surface by some method. While these methods have varied to some extent, they have been inherently the same, and their results have been similar.

The surface left by the grinding wheel is shown under a high-powered glass to be composed of sharp ridges and valleys. A cross section presents a decidedly saw-toothed appearance. The honed crankshaft presents bearing surfaces equal or superior to

A. H. Frauenthal
Who presided at the session on "Non-Productive Materials," at the Cleveland S.A.E. meeting

E. P. Blanchard
Mr. Blanchard treated a unique subject in a unique way in his paper on "Integrated Production"

those of a hand-polished shaft that has been carefully run in for 1000 miles or more.

The process of honing evens the ground surface by leveling off the ridges left by the wheel and, if continued long enough, will result in a very smooth, hard and brilliant surface at a level slightly below the bottom of the grinding marks.

Honing may be termed a modern method of lapping, using bonded abrasive blocks or stones instead of a metal block charged with abrasive. The stones are arranged in holders and are dressed to the required contour with a diamond.

Grinding errors consist principally of taper, out-of-roundness, misalignment and high or low centers and chatter marks. A crankshaft may have all of these ailments and the old method of polishing with abrasive cloth could not better any of them except possibly the last.

The action of the hone is most forcibly shown by placing a crankshaft in a honing machine, revolving it for only a few seconds and then inspecting the bearings. Chatter marks which were impossible to detect become very noticeable. Misalignment, out-of-roundness or taper are also made very apparent if present, since only the high spots have had contact with the hone.

Honing Corrects Errors

If the honing operation is continued long enough the bearings will acquire a brilliant finish over their entire surface unless the error has been too great for correction. Any error that honing will not correct is important enough to justify correcting where it develops.

Eugene Bouton
He contended that depreciation reserves are the property of the production department

A. R. Fors
He read Lee M. Beatty's paper on the manufacture of famous Wright Whirlwind engines

To perform the work of honing properly there are eight elements which must be considered. These are:

1. Grade of stone must be such that cutting grains will break away when they become dull.
2. Grain of stone must correspond with the type of surface desired.
3. Pressure of the stone has a great influence upon the work.
4. Speed of work affects the finish.
5. Time depends upon how near perfection the finish must be.
6. Dressing of stones to the proper shape is very important.
7. Flushing of work keeps stones sharp and prevents glazing.
8. Reciprocation of the work increases shearing action and prevents formation of grooves.

Removes Initial Wear

The purpose of honing is to remove the initial wear left in an ordinary bearing surface and to give the bearing a perfect form. By properly controlling the eight elements listed this can be accomplished with the utmost uniformity and, since all main and connecting rod bearings are honed at once, the operation is done at a great saving of time over the old method previously followed.

Application of Motors to Machine Tools

A fourth paper was that of R. C. Deale, Niles-Bement-Pond Co., on the application of electric motors to machine tools which dwelt particularly on the hardships loaded upon the machine tool industry and the purchasers of machine tools because of the absence of standardization in mounting dimensions among the various electric motor makers. His paper, in part, follows:

Manufacturers and users of machine tools and other motor-driven machinery have been put to great expense because of the lack of uniformity in mounting dimensions of the electric motors built by different manufacturers. Not only does no uniformity in these dimensions exist but there is very little attempt at uniformity. The old Electric Power Club, now merged into the National Electric Manufacturers Association, drew up a set of standards of shaft dimensions which were adopted as recommended practices. These are the only dimensional standards the motor manufacturing industry has in this country and but few companies are following them.

Two large classes of motor mountings exist and these require two degrees of standardization. The first comprises machines in which some type of flexible drive is used between the motor and the machines. In this class of drive the dimensions of the motor shaft extension are of most importance. Where shaft extensions are not the same each motor drive must be sent through the shop separately so that the pulley or sprocket can be machined to fit the motor being used .

Holding-down bolts must be treated separately as

no one size will do for all motors of the same rating. In the case of gear drives the situation is much more serious. This type of drive is being used frequently and is consequently becoming the most important of the various forms of motor drive. Here the shaft extension and the holding down dimensions are just as important as in the previous case. In a drive of this type it is necessary to make an attachment drawing every time a different motor is used. The pattern for the base plate must usually be altered or made specially.

Frequently it is found that the base is not parallel with the axis of the armature, sometimes to the extent that it is necessary to take a cut off the bottom of the motor feet in order to true them up.

Motor manufacturers claim that standardization of dimensions would interfere with their freedom of design but it is difficult to see any great advantage in slight alterations of shaft diameters or of holding-down bolts. According to the present status of motor design it is necessary to use about the same amount of iron and copper to build different motors of a given rating regardless of the designer.

Variations in dimensions between a.c. and d.c. motors of equivalent rating are not so serious, but it would be very desirable if all motors of a given rating were interchangeable as to mounting dimensions.

The difficulties of the machine manufacturers due to lack of interchangeability of motors are passed on to the customer in the form of lengthened shipping dates and increased costs, the causes of neither of which does he appreciate. But the most serious trouble occurs when a machine has been placed in the production line. In such a case it is desirable to replace a broken down motor with another while the former is being repaired in order not to hold up production, but with the great variations in mounting dimensions it is impossible to replace a motor of one make with one made by another manufacturer without considerable contriving.

"Integrated Production" Proposed As Economy

E. P. Blanchard's rather significant paper on "Integrated Production" was presented at the evening meeting on Monday, as was a popular talk on the part played by electricity in social and manufacturing progress given by C. M. Ripley of the General Electric Co. A major part of Mr. Blanchard's paper follows:

There are two factors which are controlled pretty much from within the shop. Material specifications are determined by the engineering department, but the finished form which those materials must take is accomplished by the production man with labor and machinery. Working with these two factors he must reduce cost.

The labor-cost factor is becoming less and less significant. This diminishing of labor-cost started over 150 years ago when it was determined that a short cycle of operations by each workman, frequently performed, resulted in faster and cheaper production than by letting one man worry through the complete process to the finished product. Motion studies and time studies have given us our present efficient workmen. But in this evolution, machinery came into the picture and has gradually taken over more and more of the responsibility for performance to the point where the modern manufacturing process is preponderantly a machine process.

These two production principles, the division of labor and the transfer of skill which have been evident in years past and with which you are all familiar, are brought to your attention again, for we may now deduce a new principle in production from some of the facts which can be observed in modern production practice.

The time study man knows that any piece of work can be broken down into the operations of which it is comprised and the machining time on each operation can be very accurately figured. He knows that with each tool cutting efficiently for each operation, it will require a definite length of time to accomplish the job. With the mechanical factors of speed and feed, the form of the cutting tools—all the factors in the tool itself which determine maximum efficiency, being constant and unimpaired—the total accumulated time per tool for all operations on a given piece of work will be the same whether the work is done with only one tool cutting at a time or with three, 13 or 30.

Production Time Shorter

The production time for the piece will be shorter with more tools cutting, provided, of course, that the correct mechanical factors of tool efficiency are still maintained in each case. The actual cutting time is shortened by the multiplication of tools in simultaneous operation. Let us coin a word and call this "simultation." This "simultation" factor is mathematical and is true of machine performance in any process of manufacture; whatever the job may be, if it is broken down into the smallest possible work units, the accumulated time of performance for all work-units will be the same, though there is a saving in total production time by the combining of work-units and by the "simultation" in performance.

In building the production process, however, these work-units are combined with careful study and attention to the conditions which will assure highest efficiency; the mechanical factors in tool performance must remain unimpaired and this process of combining work-units for highest efficiency is integration.

One cutting tool traversing the length of a plain straight bar in turning it will require three times as long as three tools, equally spaced longitudinally, for the same purpose and working simultaneously. Therefore, the "simultation" in this case is three, but if the bar were to have two different diameters and the cutting feet per minute required a different spindle speed, on each diameter, the bar becomes two separate work-units which cannot be combined under the same conditions. They are not subject to "simultation" except by compromise in the factors.

The same is true in milling conditions. Two different milling cutters may be mounted on the same arbor but if the work requires two different diameters of milling cutters which justifies a change in cutter revolution in order to maintain the proper cutting speed, then, here again, are two separate work-units.

Work-units in this manner may be multiplied indefinitely and in all manner of work, even in the production process itself, for the complete manufacturing method from raw material to finished stock is but a combination of work-units, each performed under the conditions and circumstances suiting each unit which best adapts it to highest efficiency. We can see this in printing presses, in knitting machinery, looms, paper making, or whatever. The principle is universal.

In metal cutting, however, the work-units or operations of which the finished job is composed must be combined in a manner to comply with the nature of the work and special attention must be paid to the limits of mechanical performance of machinery in any one unit. Further, in combining the units, an exact balance of work allotted to each must be maintained. To do this may require splitting up certain of the longer operations or splitting some of the greater units and increasing the "simultation" in the job, so that with every factor of the machine performing to its highest efficiency or every work-unit being performed at the highest possible rate, they will "time" or integrate to a least common multiple. The process to the ultimate finished piece will be performed in the shortest possible time. This, in effect, is a refinement of integrated production.

Obviously, the multiplication of simultaneous operation with provisions for complying with the mechanical requirements of each, calls for increasingly greater refinements. Multiple tooling is a refinement over one tool, and provision for multiple work-units, with varied conditions for each, requires refinement over multiple units having the same condition for each. This refinement can be carried to whatever extent is justified by the economy resulting therefrom. As an instance, if in cross-facing a surface of large diameter there was sufficient economy to be obtained, a machine could be designed to give a constantly increasing ratio of spindle speed as the tool approaches the center rather than the present periodical change which is included in some designs to compensate for the reducing cutting feet per minute. Economy in the materials of which cutting tools are made is even justified in some cases by the nature of the operation and the work required of the particular tools in order to accomplish its unit of performance in time to balance with the other units in the piece.

But in working toward greater profit per unit, it must be remembered that every stage in quantity production justifies its own limits in refinement of equipment and methods. There is a point in every job which provides the greatest economy for the particular quantity required and any point of refinement beyond this peak of economy enters a period of diminishing returns. This is a proportionate figuring of carrying charges on the equipment necessary as against the operating cost of performance. Fortunately, however, it is fairly simple to figure where the cost of carrying charges too greatly overburdens the operating cost. It is the part of wisdom to equip for a peak of economy somewhat beyond the proposed production quantity, allowing therein for some expansion and for taking advantage of the most that is justified in refinement.

Savings in Refinements

On this point it might be shown that the relative refinement demanded by certain quantities vary considerably in the smaller quantities of production, but that as quantities increase, and as refinement is carried to a greater extent, the savings in each case become less and less. The curve of savings flattens out considerably long before we reach quantities which are represented by that indefinite word, "mass production."

Integrated production combines the divisions of labor, the transfer of skill and intelligence in each work-unit, properly balanced, and performed simultaneously to comprise a complete process or method performed in the shortest possible time. Here is a scientific principle, quite modern and subject to even more extensive application in order to derive that greater economy which is the present objective of production engineers.

Steel Session—

THERE has been a growing realization of late that the S. A. E. physical property charts for steels incorporated in the handbook could be materially improved upon. Up to the present these charts have shown merely averages of values to be expected. Naturally there have been differences between steel samples supplied not only by different manufacturers, but also samples of the same steel from the same producer. This would be expected since slight variations in chemical composition, such as in the carbon range, and differences in heat-treating and drawing would affect physical properties.

During the past year the Iron and Steel Committee of the S. A. E. has been working on the problem of changing the physical property charts so as to give ranges of value in addition to averages. In order to much such ranges, maxima to minima, of the greatest industrial value, samples of steel were bought from four producers and sent to some 30 laboratories for analysis and tests, with drawing at various temperatures. The data thus obtained has been correlated, and the result formed the subject matter of a paper presented by E. J. Janitzky, metallurgical engineer, Illinois Steel Co., and a member of the committee.

By applying the fundamentals of probability and plotting frequency curves, a way has been evolved which in this paper is offered as a suggested method for revising the physical property charts. The procedure followed by Mr. Janitzky was to plot the frequency curves of the test data obtained, which included chemical analysis, tensile strength and Brinell, scleroscope and Rockwell hardness tests on the specimen—about 115 tests in all. Mr. Janitzky then took the area under each of these curves and converted it into a rectangle, whose base was equal to the base length of the curve in question. He then adopted the points where the upper side of the rectangle intersected the curve as maxima and minima values. A curious fact then developed was that the average of the maxima and minima thus obtained, no matter what the shape of the curve, checked almost exactly with the mathematical averages of the test data.

By plotting maxima and minima values at various drawing temperatures, and connecting these with a curve, a band was obtained. It is suggested that this band be used to represent allowable variations in the physical property values of steels.

One of the main values of this curve lies in the fact that it represents actual industrial conditions in the steel manufacture and heat treating industry today and includes all variations of manufacture as well as areas of tests which would be expected in average industrial laboratories. The object in presenting the paper was to obtain a reaction from automotive engineers, both designing and metallurgical, to the method suggested since a great deal of work would be involved in changing all the physical property charts.

Tying in well to this paper was that of J. M. Watson, metallurgical engineer, Hupp Motor Car Corp., on "The Relation of Metallurgy to Production." Mr. Watson indicated in his paper how the metallurgical

department which formerly was a separate entity in the motor car plant has grown to be an important cooperative aid to the engineering, purchasing, production, sales and service department. An interesting suggestion was made by Mr. Watson regarding cooperation which the metallurgical department can give the sales department. He suggested that metallurgical engineers should give short talks to dealer salesmen on metallurgy involved in their motor cars. Mr. Watson emphasized the necessity of giving concrete examples rather than talking in figures. Along this line he showed a series of test specimens made of various kinds of steel which, although of varying carrying diameter, had the same tensile strength. This was used in order to show dealer salesmen how the weight of the car has been kept down by using high tensile strength alloys in highly stressed parts.

A paper on 1927 grinding practice in the automotive field was given by O. A. Knight, Detroit district manager of the Norton Co. Due to the scope of this subject Mr. Knight confined himself to cylindrical grinding, using slides to illustrate new types of machinery which have been developed during the past year. He also indicated how development of machinery has resulted in reduced production costs through the adoption of more and more automatic features. In the discussion on this paper Mr. Knight stated that the trend at present, however, is toward better finishes rather than reduction in the cost of production. Lapping tools and buffing wheels are becoming widely used to obtain even higher finishes after grinding.

1927 progress in cylindrical grinding has been along lines of multiple diameter work and wider faced and larger diameter grinding wheels requiring heavier machines. Machines with semi-automatic or full automatic control are becoming more widely used. Ball and roller bearings to reduce maintenance costs are on the increase while new attachments for special grinding operations are reported.

Among the new developments are an automatic indexing cam attachment in which cam shafts and master cams are automatically swung away from the grinding wheel and the master cam roller and indexed to the master cam corresponding to the one to be ground next. Many odd shapes, including square shafts and brake cams are ground on centers. Simultaneous grinding of both hub and back of side gears is accomplished by using an angular wheel slide and wheel head carrying a wheel with a mitered face. Grinding of spherical backs of differential pinions is accomplished by means of a swiveling live spindle headstock mounted on a flat table of a cylindrical grinding machine. Swiveling is by hand, the work passing across the grinding wheel in an arc, resulting in fine finish and high production. Double wheel grinding has proved very satisfactory where the work is adapted for this method.

With the use of wider and larger wheels more attention is being paid to balancing and many wheels are being provided with balancing equipment. Much has been done in the development of cylindrical grinding in recent years.

Time Study Session—

TWO important contributions to the science of time-study were made at this session. J. Charles Mottashed, president, Society of Time Study Engineers, outlined a number of points of contact which have been neglected in relation to time study. Mr. Mottashed's paper dealt with the advisability of maintaining a "machine-load" file in addition to and separate from the "man capacity" data. Such a file should result in enabling considerable savings from year to year. By listing all machines available with their load capacities it can be determined at a quick glance what new purchases if any are required in case of an increase in production, or what machines should be used in case of a decrease in production.

M. C. Hutto

Mr. Hutto contributed a paper on "Developments in Cylinder Grinding"

P. H. Walker

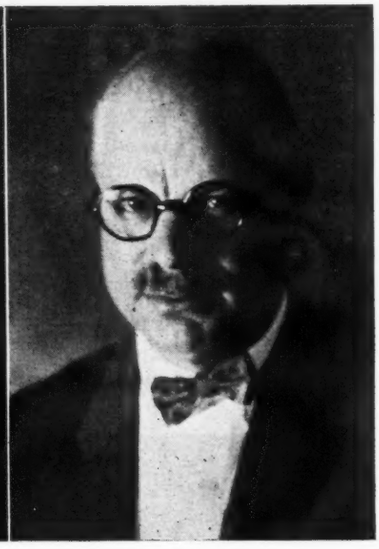
Mr. Walker discussed methods of making grinding stones

Moreover, when a breakdown occurs the file reveals what machines are available to fill the gap, or whether none is available. In addition it enables maintaining progressive production lines with a balanced load-capacity, reducing the chance of having special machinery either tying up production or being too fast for the remainder of the line. In this connection Mr. Mottashed stated that the general trend at present was toward more highly specialized rather than general purpose machines, making this problem even more important. A fourth advantage of the machine load file is that it enables better control of storerooms, purchase of raw materials, and stocks of materials in process.

The second paper, on "Time Study in Its Relation to Labor Budget," by E. J. Frounfelker, of Continental Motors Corp., was an exposition of how this company has used time-study to predetermine labor costs. By using available time-study information on similar operations on other engines, Continental Motors prepares a time-study on any new engine before it goes into production. In preparing this study seven factors are considered. The time required for picking up or handling the piece to be worked, clamping or

L. A. Becker

Mr. Becker's topic was "External Grinding." He is chief engineer, A. P. Schraner & Co.



G. T. Trundle, Jr.

Mr. Trundle showed how to get more profit from modern machine tools

chucking, and approaching and engaging feed are determined as the result of experience. Cutting time is determined from charts of speed and feeds, while disengagement and return of tools, unloading and handling, allowances for tools, fatigue, etc., are timed according to the machine and nature of the work.

When this work is completed, a general time study for each piece is made by addition and the production cost is quickly determined. When the new product goes into production a quick check-up is possible to see whether any groups of operations are exceeding the budgeted time. If this is the case attempts are immediately made to bring the time for these operations down to allotted time, either by retooling or otherwise. This has not yet presented an appreciable problem.

Since the time studies before issuing are carefully checked by all divisions concerned, including tool, production, equipment and time-study departments, very little trouble can be expected and is found due to incompatible time-allowances. Not only has this method enabled Continental Motors to perform all time-study work with a very limited number of men, but it has also been possible within the last year to produce units on a budgeted basis within one month after production started as compared with from five to six months required previously to produce units at a price considered right for the unit.

A number of objections were raised to this method in the discussion. The various questions raised, however, found a ready answer. One question as to what is done in case the required time is considerably below the budgeted allowance was met with the answer that experience in producing similar units, and well-kept files of time study data, has enabled Continental to keep such discrepancies down to a minimum. When they occur the budgeted time is generally not altered, but the operators are given the break.

Another question as to possible dissatisfaction of adjacent operators, who may be earning different wages as a result of the predetermination of labor budget, was met by the answer that the group-bonus system, used at Continental, takes care of this.

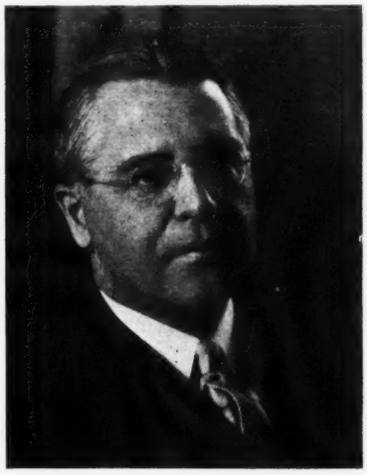
Again it was claimed that such a method might make time-study men lax in attempting to constantly reduce manufacturing costs. This again was answered by the method pursued of submitting all time studies to foremen, managers, etc., before issuing. Experience of superintendents, who in the case of Continental evidently seem to be well acquainted with the science of time-study (possibly as a result of this method), quickly indicates whether any reduction in the allotted time is possible before issuance.

Production Engineering—

IN the development of the automotive industry the automotive engineer has had, up to lately, but little contact with the sales department except in regard to features of design. A. R. Glancy, president Oakland Motor Car Co., in a talk on production engineering at the Wednesday evening session, stated that the time has now come when the engineer should become a more and more important factor in the selling end.

According to Mr. Glancy, the problem is not producing cars to take care of sales but of selling enough cars to take care of production capacity. According to Mr. Glancy, this problem has now developed into producing customers rather than automobiles. In designing a motor car the engineer should keep ever in mind the probable selling appeal. "We are not here to design or build autos," Mr. Glancy stated, "but to sell them—at a profit."

Considerable discussion followed the paper on "Fire Hazards Incidental to the Spraying of Inflammable Finishes," prepared by H. L. Miner of the E. I. duPont de Nemours & Co. at this session. Mr. Miner, who is manager of the Safety and Fire Protection Division of his company, outlined the various factors and safety precautions involved in reducing fire hazards with spraying equipment. Mr. Miner pointed out that ventilation sufficient to dilute vapors in a spraying booth to below the explosive range should be sufficient to reduce fire hazards from this source.



A. R. Glancy

Mr. Glancy, who is president of the Oakland Motor Car Co. and a production man of long experience, talked to the engineers on "Production Engineering"

Automotive Topics *in* Foreground at *Steel Treaters'* Meeting

Paper reveals that high-alloy, case-hardened steel is now being used for rear axle shafts. F. G. Hughes is slated for presidency during 1927.

By P. M. HELDT

ONE of the most interesting points from an automotive standpoint developed at the meeting of the American Society for Steel Treating, held in Detroit from Sept. 19 to 23, was that high-alloy, case-hardened steel is now being used for rear axle shafts.

So far case-hardened steel has been used only on account of its surface hardness and consequent resistance to wear by abrasion. It was brought out in the paper on the fatigue strength of carburized steel, by Prof. Moore of the University of Illinois Experiment Station, that the resistance to fatigue stresses of a low-carbon steel can be greatly increased by carburizing and case-hardening, and in the discussion of this paper John Miller, metallurgist of the Pierce-Arrow Motor Car Co., pointed out that his company is now using case-hardened driving shafts in the rear axles of its 2-ton trucks with good results.

Trouble had resulted previously with high-alloy 0.30 per cent carbon, oil-hardened steel owing to the habit of users of grossly overloading the trucks. The steel now used contains 3.5 per cent nickel, 1 per cent chromium and 0.15-0.20 per cent carbon, and is carburized to a considerable depth. With this high alloy steel only a single quench is required, which hardens the case and refines the core, instead of the double quench with the simple carbon case-hardening steels.

A good many of the papers were of direct interest to automotive engineers and automotive metallurgists. The sessions were held in the ball room of the Hotel Statler and were well attended. Steel experts and steel treaters had come from far and near and the eagerness of those in attendance to learn something useful to them in their vocation was reflected by the close attention paid to the speakers and the questioning which usually followed the presentation of a paper.

Business Session

At a business session held on the opening day it was pointed out that the American Society for Steel Treating was formed less than 10 years ago by the amalgamation of two small and struggling associations having similar names and endeavoring to represent practically the same interests. On Aug. 31 last, the society had a membership of 4635, a gain of 653 during the year. The society works largely through local chapters, some of which endeavor to spread information on heat-treating by giving practical courses of instruction on the subject. J. Fletcher Harper, research engineer of the Allis-Chalmers Co. of Milwaukee, is president of the society for the current year, while F. G. Hughes, vice-president of the New Departure Mfg. Co., Bristol, Conn., is slated for the post for next year.

The sessions on the opening day of the meeting were particularly well attended. Later on visits to plants and the steel and machine tool exposition detracted somewhat from the attendance. The program was arranged so that all or most of the papers at any one session bore on closely related subjects. Thus, for instance, the papers presented at the Monday afternoon session all related to different phases of case-hardening practice, those presented at the Tuesday morning session to foundry problems, at the Tuesday afternoon session to tool steel (high-speed steel), etc.

Gas Carburization

Two papers relating to the gas carburization of steel were presented, and it appears that this process, whereby low-carbon, case-hardening steel is caused to acquire a high-carbon case by being subjected to the presence of commercial gases at high temperatures, is making good progress. One difficulty so far has been irregularity in the results, which it has been impossible so far to trace to its causes. Sometimes a case of ⅛ in. is obtained in four hours, while in other cases it takes 24 hours to obtain a case of the same depth from gases of apparently the same analysis. There is no difficulty in getting uniform results with one furnace charge. Best results are obtained with dry gas, that is, gas containing no water vapor, and it appears that the unsaturated hydrocarbons in the gas are the chief carburizing agents.

Most of the papers elicited lively discussion, and there was also considerable written discussion. Following are abstracts of the papers of more or less direct automotive interest that were presented at the meeting:

G. M. Eaton, of the Molybdenum Co. of America, presented a paper on "Design from the Heat-Treating Standpoint." He discussed at length the failures occurring with railway bolster springs and the causes thereof. These springs are made of very heavy spring wire and are coiled while at forging heat. Until recent years these springs were quenched in still oil. Owing to the closeness of the convolutions the cooling was less rapid on the sides and more rapid on the inner and outer surfaces of the wire. The stress in a wire spring is a maximum at the surface of the wire on the inside of the coil and premature failure undoubtedly results from the hoop tension in the wire in the early stages of the quench. The failure always starts at or near the inside

diameter of the spring coil from a small but well-defined nucleus. The coiling, of course, subjects the steel of the spring to stresses. If there are any fine longitudinal cracks on the surface of the wire on the inner side, the coiling will cause them to open up. But if the wire is twisted before coiling the cracks can be caused to remain closed. The presence of such cracks in a piece which is quenched involves great risks.

The author discussed the effect of various methods of quenching by water and air jets, with the spring stationary or rotating, showing how the problems of the mechanical designer are bound up with those of the heat treater.

Heat Treater—Designer Cooperation

"Why the gap between the metallurgist and the mechanical engineer?" he asked. "How can the two professions get together to close up the gap that now yawns between them?

"The A. S. S. T. focuses the metallurgical and heat-treating ability of the country. The A. S. M. E. bears the same relation to the mechanical designing brains of the country.

"The problem of starting something of a constructive nature that will gradually evolve itself into the easing of our difficulties is something of the greatest complication and difficulty. It involves patient cooperation with our educational institutions in their difficult problem. It involves clear vision of the needs of industry and the establishment of intelligent research, and it involves sticking to it until the results come through.

"I offer for your serious consideration and discussion the suggestion that a joint body be appointed by the two societies, and that on this body be laid the duty of tackling the job of bridging the gap between the art of the heat-treater and that of the designer."

D. M. Houston, foundry engineer of the Development and Research Department of the International Nickel Co. of New York, presented a paper on the "Economic Value of Nickel and Chromium in Gray Iron Castings." He gave approximate equivalents to assist in determining the nature of the structure that may be obtained from an alloy mixture compared with one of plain iron or semi-steel. These approximate equivalents are as follows:

One point of carbon equals three points of silicon in reducing chill; one point of carbon equals six points of nickel in reducing chill; one point of carbon equals three points of chromium with respect to chill.

Hardness in Cylinder Walls

According to the author, automotive engineers are more and more demanding greater hardness in cylinder walls and valve seats. But as the hardness of the walls is increased the shop is continually confronted with the problem of hard edges and poor machinability. While the cylinder walls are not heavy, they cool much more slowly than other parts of the casting and cylinders in plain gray iron are invariably much softer in the piston ring travel portion (over which the jacket core is located) than in any other part. This, of course, is due to the breaking up of the iron carbides in the same manner as in heavy, slow-cooling sections.

The addition of 0.3 to 0.4 per cent chromium and 0.6 to 0.8 per cent nickel usually produces a minimum Brinell hardness of 200 in the cylinder wall without decreasing machinability, when used in a base composition giving 160 to 170 Brinell hardness. However, the hardness values obtained will depend somewhat upon the design and upon the composition of the base metal, so that the alloy percentages may have to be varied somewhat under some conditions.

That a better structure having greater strength and density and having a greater resistance to wear can be secured by the use of alloys in gray iron is now accepted generally by metallurgists. The chief objection to their use commercially is the increased cost. It was the purpose of the investigation conducted as shown by the accompanying data to develop a base composition requiring only a low alloy content to secure improved structures and properties equivalent to those of higher alloy irons in which the base composition had not been properly adjusted to alloy additions.

The importance of the base composition as well as of the nickel chromium ratios is shown in Table I and II. Cylinders of mixture No. 1, with 2.05 per cent silicon and 3.45 per cent total carbon, having a 3 to 1 nickel chromium ratio, gave a variation in Brinell hardness number of 13. Mixture No. 2, with practically the same base, but a 2¾ to 1 nickel chromium ratio showed a variation of 20 in the Brinell hardness. Mixture No. 3, having virtually the same analysis as No. 1, except that the nickel chromium ratio is 2 to 1, gave a difference of 18 Brinell hardness. Mixture No. 4, virtually the same as No. 2 but with a 1¼ to 1 nickel chromium ratio, gave a difference of 33 in the Brinell hardness. Mixture No. 5, the plain iron, showed the maximum difference of 50 in the Brinell hardness, while mixture No. 4 would seem the most effective from the hardness point of view. Mixture No. 1 is more uniform in hardness which is characteristic of 3 of nickel to 1 of chromium ratio. Mixture No. 3 is next in uniformity of hardness, but has a 2 of nickel to 1 of chromium ratio. No. 2 gave 6 point higher average hardness due to 13 points lower total carbon with 12 points less of nickel. No. 3 with the higher total carbon and a ratio of 2 of

Table I

Materials Used in Making up Charge

	ALLOY IRON									ANALYSES				
Mixture No.	Return Scrap	Steel	Federal	Zenith	Mayari	Silvery	Ounces Ferro-Cr	Lbs. Ni Shot	Si	TC	S	Ni	Cr
1	500	150	312½	...	...	37½	12	4.66	2.05	3.45	0.095	0.53	0.14
2	500	150	312½	...	...	37½	15	4.66	2.05	3.32	0.096	0.41	0.15
3	500	150	312½	...	...	37½	35	4.66	2.11	3.43	0.095	0.51	0.25
4	500	150	312½	...	...	37½	77	4.66	2.07	3.34	0.094	0.47	0.37
	PLAIN IRON												
5	400	150	225	100	50	75	..	...	2.34*	3.30	0.076	0.055	0.09

* Nickel and chromium are impurities.

Table II

BHN Data on Cylinder Walls

	Location of BHN on Cylinder	Mixture No. 1	Mixture No. 2	Mixture No. 3	Mixture No. 4	Mixture No. 5
	1	167	184	198	227	179
	2	177	177	187	190	143
	3	170	170	198	198	131
	4	164	170	184	194	131
	5	177	177	181	196	137
	6	174	178	202	198	163
	7	177	190	184	221	181
Average BHN		172	178	191	203	152
Additional Cost			6 Cents	12 Cents	18 Cents	35 Cents

nickel to 1 of chromium seems to indicate that total carbon is a factor in uniformity of hardness values.

The ideal economical mixture then would be Mixture No. 1 having a silicon content of perhaps 1.85 or 1.90 per cent and the 3 nickel to 1 chromium ratio, and this will furnish Brinell hardness number values equivalent to Mixture No. 4 at about the same price of plain iron.

In Table III the costs of the materials in the different mixtures are given. The cost of alloys used to treat 1000 lb. of mixture No 4, which was adopted as having machinability equal to plain iron, and an average Brinell hardness of 203 as compared with 152 in plain iron, amounts to $2.11. Sixty per cent of this alloy ($1.27 worth) was consumed in good castings and 40 per cent (84 cents worth) was reclaimed as foundry returns. This represents a credit of 84 cents on the total cost of $11.07, making the net cost $10.23 or 35 cents per 1000 lb. greater than the plain iron.

Ball Bearing Steels

Tests on two steels for ball bearings were described in a paper by Dr. Bengt Kjerrman, metallurgical engineer of the S. K. F., Gothenburg, Sweden. These two steels had the following compositions:

	Composition in Per Cent					
Heat	C	Cr	Mo	Mn	P	S
U-887	1.01	1.54	...	0.38	0.354	0.024	0.008
Y-208	1.00	1.77	0.21	0.41	0.282	0.020	0.012

These steels were made in acid open-hearth furnaces and were tested by electric resistance measurements at varying temperatures; by electrical resistance measurements at constant temperature on specimens quenched in water from different temperatures ("hardening curves"), and finally subjected to experimental annealing and hardening tests with subsequent hardness determinations and microscopic examination. The first of the two steels is that commonly used for ball bearings, while the second has a larger chromium content and also contains some molybdenum.

Normal and Abnormal Steels

For some years low carbon steels as used for case-hardened parts have been classed as either normal or abnormal, according to their reactions to the carburizing process, as revealed by their micro-structure after carburizing. A study of such steels was made during the past year in the School of Mines and Metallurgy, University of Minnesota, and the results were presented and discussed in a paper by O. E. Harder, L. J, Weber, and T. E. Jerabeck.

The authors sought to convert normal into abnormal steels and vice versa by the following methods among others: From abnormal to normal by heating in vacuo at carburizing temperatures; from normal to abnormal steel by heating in various gaseous atmospheres at carburizing temperatures; from abnormal to normal steel by melting in vacuo; from normal to abnormal steel by melting in certain atmospheres; from normal to abnormal steel by heating to carburizing temperatures in contact with various materials representative of those sonims which may be present in any steel but particularly in those steels which are incompletely deoxidized or deoxidized late in the steel making process.

The following conclusions are drawn from the results of the experiments:

1. Heating abnormal steel in a vacuum at the carburizing temperature has no apparent effect in regard to its normality.

2. Heating a normal steel in nitrogen at 1725 deg. Fahr. did not change its carburizing properties. This may be due to the nitrides not being formed by heating steel in nitrogen gas at this temperature.

3. Heating normal steels in oxygen at 1725 deg. Fahr. causes the steel to take on abnormal carburizing characteristics. This is believed to be due to the formation and solution of the oxides in the steel.

4. Heating normal steel in carbon dioxide at 1725 deg. Fahr. produces an abnormal steel. This is thought to be due to the oxidizing action of carbon dioxide.

5. The effect of heating normal steels in contact with various oxides at the carburizing temperature, is to cause solution of the oxides in the austenite and thereby to produce abnormal steels. The depth of penetration of oxides is proportional to the time of heating, as also to a great extent is the degree of coalescence of cementite in the carburized steel or the abnormality of the steel.

Of the various sonims studied, ferric oxide (Fe_2O_3) seems to show the most rapid penetration and to produce the most abnormal steel for a given time of heating at the temperature studied. This relation may be due to its higher oxygen content and the greater ease with which it will give up some of its oxygen.

The rate of penetration of the oxide or oxygen, as determined by the formation of an abnormal carburizing zone, is exceedingly slow as compared with carbon penetration, for example. The carbon is able to penetrate through a surface of abnormal steel and then produce a normal hypereutectoid zone. The more rapid penetration of the carbon as compared with that of the oxygen is probably attributable mostly to the relative affinities of oxygen and carbon for iron, or to state the same relation in another way, the relative stabilities of iron carbide and iron oxide compounds. In addition, the carbon atom is smaller than the oxygen atom and should for that reason diffuse more rapidly.

6. X-ray analyses show that in the abnormal steel the lattice dimensions are greater than those of normal steel, indicating the presence of foreign material, probably oxide, in solid solution in the ferrite. Probably the mechanism of this phenomenon is more correctly stated by saying that the oxygen goes into the iron space lattice and there exercises some bonding valences with the adjacent iron atoms.

7. Melting an abnormal steel in vacuo in alundum crucibles considerably decreased the abnormal tendency as regards massive cementite but still gave a steel which would not produce a hypereutectoid zone on carburizing and the pearlite was coarsely laminated.

8. Melting a normal steel in vacuo in an alundum

Table III

Cost of Mixtures per 1000 Lb.

Materials Used	Mixture No. 1	Mixture No. 2	Mixture No. 3	Mixture No. 4	Mixture No. 5
Return Scrap	4.00	4.00	4.00	4.00	3.20
Steel	1.35	1.35	1.35	1.35	1.35
Federal	3.07	3.07	3.07	3.07	2.21
Zenith	...	...	...	...	1.16
Mayari	...	...	...	...	.88
Silvery	.54	.54	.54	.54	1.88
Total Plain Iron	8.96	8.96	8.96	8.96	9.88
Ferrochromium	...	.10	.20	.48	...
Nickel	1.63	1.63	1.63	1.63	...
Cost of Alloys	1.63	1.73	1.83	2.11	...
Total Cost	10.59	10.69	10.79	11.07	9.88
Return Recovery 40% of Alloy.	.65	.69	.73	.84	...
Net Cost	9.94	10.00	10.06	10.23	9.88
Net Additional Cost of Alloy Addition	.06	.12	.18	.35	.00

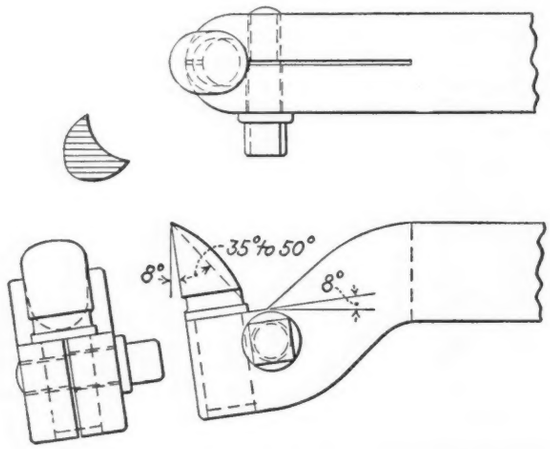
Costs	Per Ton	Per. Lb.	Costs	Per Ton	Per. Lb.
Zenith	26.07	.01164	Mayari	39.18	.0175
Federal	22.02	.00983	Nickel	.....	.3500
Steel	18.00	.009	Ferrochr.	.....	.1000
Return	16.00	.008	Silvery	32.29	.01441

crucible produced steel that showed abnormal characteristics with regard to the absence of hypereutectoid zone.

9. Melting an abnormal steel in vacuo in a magnesite crucible decreased its abnormal tendencies but did not produce an entirely normal structure.

10. Melting a normal steel in a magnesite crucible in vacuo produced a steel with abnormal tendencies, but a steel which would show a hypereutectoid zone on carburizing.

11. Normal steel melted in nitrogen in an alundum crucible gave steel which showed abnormal on carburizing both as to the character of the pearlite and the absence of hypereutectoid zone.



Form of lathe tool recommended for aluminum

12. Melting normal steel in carbon monoxide in alundum crucible gave a fine-grained eutectoid structure in which the pearlite was rather abnormal and showed no hypereutectoid zone.

13. A diagram has been drawn to illustrate the probable mechanism of the formation of the structure in abnormal carburizing steel. This diagram is in agreement with the information available at the present time so far as the authors know, but evidently will require further investigation.

Metal Saws of High-Speed Steel

Saw blades, according to Henry B. Allen, of the Henry Disston Sons Co. of Philadelphia, is the last tool to be made of high-speed steel, although they are probably the oldest tool used in the fashioning of metals. Until recently plain carbon steel was used for hack saw blades, the same as it had been previously for all other tools, but the carbon content of the hack-saw steel was unusually high, about 1.20 per cent. With the introduction of the microscope it became evident why such a high carbon steel gave the best blades, which disclosed the nature and distribution of the hard carbides.

When low-tungsten tool steels were introduced they were found admirably adapted for hack saws and came into wide use. Here again the carbon content was usually quite high. Except for the high-speed steel blades which are now being introduced, the majority of the hack saws made today are made of low tungsten steel.

Recently a saw blade has been introduced which is made of a very high (around 12 per cent) chromium steel with high carbon and some molybdenum and cobalt. This steel is said to be literally packed with carbide particles, and a blade made from it is claimed to last longer than one of the usual steel.

The author discussed the question as to why the application of high-speed steels to hack saw blades was so long deferred, and reaches the conclusion that it was due to a state of mind of consumers, who considered such blades, as well as files and similar tools, cheap articles costing only a few cents each which are thrown away after having served for a short period, and who could not see the advantage of paying the extra price necessitated by the use of the better steel.

Mr. Allen also gave a classification of the various tools of the saw type used in metal working, together with their characteristics. The different types are as follows:

Types of Metal Saw

The friction disk, which may have a smooth or a nicked edge, operates, as its name implies by friction. It literally melts its way through the piece being cut. In order that enough heat be generated the disk is run at tremendous speeds, up to a rim speed of 4 miles or more per minute. It is used principally for cutting structural and tonnage steel to length, or, in general, where a smooth cut is not essential and where the heat developed will not set up air hardening checks in the work.

The fast running circular saw is a toothed blade operated at rates up to about 15,000 feet per minute rim speed. In some cases it operates partly by friction, as does the friction disk, but often by pure cutting as when used on thin sections of softer nonferrous materials.

The slow running circular or milling saw, as its name implies, is operated according to usual machine shop practice and cuts in the same fashion as does a milling cutter. The teeth may be integral with the blade or may be removable. This type of saw may be used wherever an accurate, clean cut is required.

The band hack saw is a narrow, thin continuous strip, with teeth along one edge. It finds application for general cutting off operations, and, except for thin sheet and nonferrous metals, runs at more or less conventional metal cutting speeds.

The reciprocating hack saw is so generally familiar to those whose interests bring them in touch with metals that little need be said about the way it operates.

Recent experiments on the wear of plug gages were covered in a paper by H. J. French, senior metallurgist, and H. K. Herschman, assistant scientist, Bureau of Standards. Results were given of tests made in a laboratory wear tester in gaging file-hard high carbon steel, an aluminum piston alloy and a cast iron containing appreciable proportions of pearlite. The following conclusions were drawn:

1. Gage metals which show material resistance to wear when used on parts of one metal do not necessarily show superiority when used on parts of another metal.

2. Of the numerous metals and treatments studied, chromium-plated gages showed the best resistance to wear in the metal-to-metal wear tests under consideration. The ammonia treated chromium-aluminum steel, called Nitralloy, was second in order of wear resistance. Those two metals were much superior to the remainder of the group, which showed variations but no radical differences in wearing properties. An exception was the file-soft oil hardening tool steel which was third in resistance to wear.

3. File-soft gages made from high carbon steel were generally superior in wear resistance to gages made of corresponding steels in the file-hard condition. However, the file-hard steel gages were not as badly scratched after test as the file-soft gages.

4. Gages made from Stellite, from a high-carbon high-chromium iron alloy and from hardened high speed steel were found to have fewer scratches than the gages made from file-hard or the file-soft ball race, 1.05 per cent carbon and oil hardening tool steels or chromium-plated gages. The last named consistently showed much the highest resistance to wear, but were found to be badly scratched after test. However, this was ascribed to the conditions of service which permitted particles of the brittle chromium, torn from the electrodeposit, to become imbedded in the relatively softer metal with which the chromium plate was in contact. Due to the high hardness of chromium these imbedded particles were able to score the plate. The Nitralloy gages were not scratched, but appeared to be pitted; this was ascribed to the brittleness of the nitride case which permitted particles to be torn from the surface of the gages.

5. As the conditions of gaging became more severe, either through a change in the metal gaged or by the introduction of a non-metallic abrasive, differences in wear resistance of the different gage metals became less marked. In the abrasive wear tests Stellite showed the best wear resistance while the chrominum-plated gages and the high-carbon high-chromium iron alloy gages were next in line.

6. In gaging the file-hard high carbon steel (without abrasives) dark areas frequently appeared on the surfaces of the gages; these were presumed to be iron oxide. In gaging wrought brass containing about 70 per cent copper and 30 per cent zinc, copper-colored or brass-colored deposits were observed on the gages which made it impracticable to study wear resistance of the different metals. This applied to tests made dry or in the presence of various liquids such as water, alcohol, sodium bicarbonate solutions, etc.

Proportional Limit at High Temperatures

Francis B. Foley, superintendent of research for the Midvale Steel Co., Nicetown, Pa., has made a study of the significance of the proportional limit of steel at elevated temperatures. He reached the conclusion that as the temperature of the steel increases, it is possible to greatly increase the distance between atom centers without producing permanent deformation. On the other hand, the stress which is required to produce spacing decreases. This is evident from the decrease of the modulus of elasticity from 29 x 10^6 in the carbon 0.24 per cent steel at room temperature to about 18 x 10^6 at 1100 deg. Fahr. (595 deg. C.).

It appears quite possible that, when certain data are available, such as expansion coefficient, relationship of strain at the proportional limit to temperature and the change of modulus with temperature for various steels, a mathematical analysis will furnish the basis for the computation of the probable elastic limit at elevated temperatures from that obtained at room temperature.

Aircraft Metallurgy

Horace C. Knerr, consulting metallurgist of Philadelphia, in his paper on aircraft metallurgy pointed out that aircraft design is tending toward the all-metal type, that the metallurgical requirements of the aircraft industry are particularly exacting and they are a stimulus to the development of improved processes and materials.

Materials used in the Liberty engine are still typical of most aircraft engines, except for the introduction of forged and cast-aluminum alloys for certain parts, and the use of improved heat-resisting alloys for valves. In the Liberty engine, such parts as crankshafts and connecting rods were made of 3½ per cent nickel, chrome-nickel or chrome-vanadium steel having 0.30-0.40 per cent carbon and showing 175,000 lb. tensile strength, 150,000 lb. elastic limit, 12 per cent elongation and 40 per cent reduction of area; parts requiring medium strength were made of S. A. E. 1035 or 1045 carbon steel showing 90,000 lb. tensile strength, 60,000 lb. elastic limit, 18 per cent elongation and 45 per cent reduction of area; parts requiring deep forming, welding etc., of S. A. E. 1010 to 1025 steel with a tensile strength of 50,000 lb., an elastic limit of 30,000 lb., and an elongation of 22 per cent; crankcases, etc., of an aluminum alloy containing 8 per cent of copper and having a tensile strength of 18,000 lb. and 1.5 per cent elongation and pistons of an aluminum alloy having 10 per cent of copper, 18,000 lb. tensile strength.

In the Wright Whirlwind engine the crankcase, cylinder jackets, pistons and certain other castings are of a heat-treated high-strength aluminum alloy known as the Y alloy. Little carbon steel is used except in the cylinder barrel forgings. Forged parts, such as the connecting rods, are of chrome nickel steel No. 3140, drop forged and machined after heat-treatment. Chrome-nickel steel No. 3115 is used extensively for case-hardened parts.

Many Small Metal Parts

Aircraft have many small metal parts, such as bolts, eye bolts, terminals for wire stays and for struts, ends of wing beams, clevis pins, shackles, etc., nearly all of which are vital members carrying concentrated loads. These are principally drop forgings, screw machine parts and fittings made of sheet steel pressings and tubing. Struts, wing beams and ribs, fuselage members, hulls for pontoons and boats, etc., formerly made of wood, and in some cases even wing coverings of planes and bags of dirigibles are now being made of metal.

At the time of the armistice there was much confusion as to the materials used in aircraft. The Army and Navy, which were the only consumers, each had its own specifications and standards.

Beginning in 1923, periodic conferences were held between representatives of the Army and Navy and of manufacturers of aircraft equipment at which simplification of materials specifications was worked for. Mr. Knerr gave tables of physical properties of standard Army-Navy aircraft steels and of wrought aluminum alloys. One of the requirements in aircraft work is that metals must be protected against corrosion.

Structural members of aircraft carrying high stresses are usually of thin section (often as thin as 0.035 in. or less), therefore it is important that deterioration by corrosion be prevented. Corrosive attack is especially active near salt water. For steel parts, a coating of zinc a few thousandths of an inch thick, applied by electroplating, is excellent. A satisfactory zinc coating should withstand continuous exposure to a spray of salt water (under specified conditions) for a period of 100 hours, without the appearance of rust. Electroplating with cadmium to a thickness of only a few ten thousandths, has given even better results than zinc plating, and does not interfere with thread tolerances.

Nickel plating and other common metallic coatings are without merit.

No form of electroplating has as yet been found entirely satisfactory as a protection for aluminum or its alloys. Chromium plating is being investigated.

Aluminum enamel, consisting of spar varnish with a pigment of aluminum powder, is an excellent protection for steel or aluminum alloys, and in fact for nearly all types of aircraft materials. It can be applied over electroplated surfaces.

The protection of internal metal surfaces, such as the inside of tubular members and the adjacent surfaces of welded fittings, has long been, and still is, a serious problem in aircraft construction. In spite of efforts to hermetically seal by welding or otherwise, moisture is almost certain to reach the interior of cavities by condensation from the atmosphere. It is then retained there, and may cause almost complete loss of strength by corrosion from the inside, while the member still presents a perfectly sound appearance.

Aluminum alloys of thin section must be very carefully protected against corrosion. These are readily attacked by moisture which remains in contact for a considerable period, although when application is intermittent followed by thorough drying, they are rather resistant, due, perhaps, to the formation of a protective coating of oxide.

Fatigue Strength of Carburized Steel

Some progress has been made in the application of corrosion resistant ferrous alloys in aircraft construction. Of these, stainless iron (carbon under 0.12 per cent, chromium 12.0 to 16.0 per cent) has excellent promise, as it can be produced in the form of bar, thin sheet, and seamless tubing, is moderate in cost, is readily fabricated, welds well, and after heat treatment develops physical properties similar to those of alloy steels now used, which it may therefore replace without change in design.

H. F. Moore, research professor of engineering materials, and N. J. Alleman, assistant engineer of tests, University of Illinois, presented a paper on Fatigue Tests of Carburized Steel. Three steels were studied, a carbon steel, No. 1020, a nickel steel, No. 2320, and a chrome nickel steel, No. 3120. The carburizing treatment for each steel was carried out with the idea of obtaining a case 1/32 in. thick. The following heat treatments were used:

Heat Treatment	Details of Heat Treatment
A	Steel tested as received (hot-rolled)
B	Steel carburized and oil-quenched from pot
C	Steel carburized, oil-quenched from pot, and then heated to refining temperature for the case*.
D	Steel carburized, oil-quenched from pot, heated to refining temperature for core, and then heated to refining temperature for case*.
E	Steel carburized and cooled in pot.
F	Steel carburized, cooled in pot, and then heated to refining temperature for the case*.
G	Steel carburized, cooled in pot, heated to refining temperature for core, and then heated to refining temperature for case.

* S. A. E. values.

The results of the tests showed that carburizing followed by suitable heat-treatment increased the fatigue strength of the speciments tested, and the tensile strength was also increased, but by a smaller percentage than the fatigue strength. In the tension test specimens the stress is more nearly uniform over the cross-section than is the case for the rotating-beam fatigue specimens, and the strength of the uncarburized core plays a more important part in determining the strength of a tensile specimen than is the case for a rotating-beam fatigue specimen, in which the outer part of the specimen is under a much greater stress than is the core. In other words, under bending (or torsion) carburizing and heat treating the surface of a specimen, or a machine part, adds strength where the bending stress is greatest, that is, at the surface, strength is added where most needed.

In the tests of the carbon steel (S. A. E. 1020), some lots of steel were allowed to cool in the pot after carburizing (Treatments E. F and G). In all other cases the steel was oil-quenched after carburizing. In the case of the steel allowed to cool in the carburizing pot the increase in fatigue strength due to carburizing was distinctly less than was the case for the specimens oil-quenched from the carburizing pot. The steels cooled in the pot were markedly improved in fatigue strength by subsequent refining treatments, the proportionate improvement due to the refining treatments being decidedly greater than the proportional improvement of the oil-quenched steel. However, the best values for endurance limit for these cooled-in-pot steels did not reach the values for the endurance limits of oil-quenched steel. The difference in depth of case makes quantitative comparisons impossible.

For the carbon steel the greatest increase in fatigue strength is shown by the specimens quenched after carburizing and not subjected to subsequent refining heat treatment. For the nickel steel and the chromium-nickel there is not much difference between the fatigue strength of the specimens tested with no treatment but carburizing and oil quenching and that of the specimens given subsequent heat treatment for refining the grain. However, the results indicate that quenching carburized steel without a subsequent grain refining heat treatment diminishes the ductility of the steel, and, presumably, its resistance to shock.

In general, the test results suggest that carburizing followed by suitable heat treatment is a promising means of increasing the fatigue strength of steel under bending (or torsion) as well as an effective means of increasing surface hardness.

Deep Etch Test

H. G. Keshian, metallurgist of the Chase Companies, Inc., Waterbury, Conn., discussed the deep etch test for iron and steel which was first used by Sorby about 40 years ago and has been widely used since on ingots and rail sections but has been applied to tool steel only recently. The test is a most useful means of detecting structural defects in steel, and if properly manipulated it has a wide field of application. It shows to a certain extent the history of the steel from the ingot to the finished bar, and indicates the amount and the direction of the work which the metal has received. This last feature makes it particularly useful as an aid in the study of plastic deformation of iron and steel parts made by the drop-forging, stamping and pressing processes.

W. J. Merten, metallurgical engineer with the Westinghouse Electric & Mfg. Co., pointed out that the practice of evaluating the physical properties of heavy steel castings from test results obtained from small coupons formed on the castings is unsafe, as the coupons have better physical properties than the core metal of

heavy sections. Extensive tests on coupons and on core-drilled bars led to the following conclusions: The grain structure of large-section carbon steel castings is not uniformly refined at the relatively low temperature of the annealing treatment ordinarily employed in steel foundries. Complete refinement does take place at considerably higher temperature and a steel casting of uniformly high strength and high ductility is produced.

Our present practice of evaluating characteristics of steel castings from tests on small coupons, does not give the properties of the casting in heavy and critical sections, and should be replaced by core drill tests from the body of the castings wherever possible; if this cannot be done, the dimensions of the coupons should be equivalent to those of the heaviest or critical section of the casting. This full size coupon must be heat treated integral with the casting, if it is to be representative of the physical properties of the casting.

Core drill tests from center sections of large castings can meet the values specified and usually only met by coupon tests, provided high temperature treatment for breaking up of cast structure is employed, the minimum temperature being 2000 deg. Fahr. (1100 deg. C.) for ordinary carbon steel castings.

Furnace Development

W. M. Hepburn, vice-president in charge of engineering developments of the Surface Combustion Co., New York, spoke on furnace development in heat treating and forging. He stated that heat-treatment of structural parts had a history of only little over 20 years and that the advent of the automobile industry had a strong effect in greatly accelerating heat-treating practice. At the Ford plant in 1905 heat-treating consisted in case-hardening one or two parts, while today in the case of a typical six-cylinder car 190 parts must be heat-treated. Considering the number of times each part must be heated in order to meet the specifications it may be said that 490 steel parts must be handled by the furnace equipment for each car.

Steels used for deep drawing operations, such as required for automobile fenders, for instance, now receive a normalizing treatment at the steel plants. The sheets pass through the furnace individually on rotating disks. The author gave particulars of a recently installed continuous sheet normalizing furnace. The sheets are brought up to temperature while in motion in less than two minutes, the atmosphere is maintained reducing to prevent the formation of scale, the temperature gradient is fixed for each foot of travel to produce the proper refinement, and the conveyor mchanism must deliver each sheet free from pits and scratches. The furnace has a capacity of four tons of material per hour and is gas-fired.

Mr. Hepburn said that even though the impetus came from the automobile industry, the steel industry must be credited with instituting scientific heat-treating methods, and the latter has made important contributions to the gas industry. For every ton of steel it produces it burns two tons of coal and about 60 per cent of this is converted into gas in some form.

A modern type of carburizing furnace was described, with a capacity of 1800 lb. per hour. The gear blanks to be carburized are packed in boxes 18.5 in. wide by 10 in. long by 12 in. deep and there are a total of 105 boxes in the furnace at one time, the gross weight of the boxes being 205 lb. The furnace is constructed of 9 in. fire brick and 9 in. insulation. Surface combustion is utilized, a process by which the gases and air are intimately mixed in the proper proportion and the resultant mixture is burned in small molded combustion tunnels in the side walls. The heat evolved is then distributed by the particular arrangement of the burners. In the case of the sheet normalizing furnace about 80 per cent is directed under the hearth. The entire equipment is controlled by two automatic temperature controls, one controlling the inlet temperature and the other the temperature of the soaking zone.

The heating of steel for forging is an old art but the least advanced of all metallurgical heating operations. With present forges the surfaces of the bars is usually overheated before the core reaches a forging heat. An improved furnace design must provide for high production, long soaking period (to insure uniform heating) and a non-oxidizing atmosphere. Mr. Hepburn said a continuous type of forge furnace can be arranged to meet these conditions.

A continuous type of forging furnace for heating crankshaft billets was described. It is equipped with automatic temperature controls which maintain a constant temperature in the furnace regardless of the production. The firing equipmeint is of the automatic proportioning type whereby the atmosphere is kept slightly reducing. The combustion zones are so located that heat is applied to the work from both the top and bottom, and the length of time required to heat the piece through is only about half as great as with the slot type of forge, which heats from above only. The outgoing flue gases preheat the incoming work, so that a high efficiency is maintained. Twenty-five billets weighing 76 lb. each have been forged from this furnace in 15 min.

The machinability of metals was discussed in a paper by Orlan W. Boston, professor of shop practice and director of the Department of Engineering Shops of the University of Michigan. The term "machinability" has been given considerable prominence in recent years, but, like "hardness" it is not clearly defined and may be expressed in several different ways.

Machinability of Metals

Most of the methods which have been used or proposed by various experiments as means of indicating the machinability of metals, deal with the force on the tool or the power absorbed, the life of the tool, or the finish left by the tool. In the first, where the force or power is measured, the material being tested is the only variable, as even an inferior tool will retain its geometric shape and cutting edge throughout a large number of comparative tests. In the second, where the tool life is concerned, the variables of the tool material and treatment are to be reckoned with. This method, however, is more practical commercially, as it is a duplication of actual shop work and also because of the lack of interest of the manufacturer in the first method involving economy of power. The third method naturally confines itself to those cutting operations which are final and appears to be a function of the tool form and cutting speed.

Several methods which have been used to determine the relative machinability of metals are as follows:

1. The measurement of the force in the direction of the cut on a tool of given geometric form required to remove a chip of definite cross sectional area and shape at a given speed.

2. The measurement of the power required for a standardized tool to remove a specific chip of various materials.

3. The ability of a standardized tool to cut various materials. This may be measured, (a) in terms of the life of the tool for a given cutting speed, or (b) in terms of the cutting speed for a definite tool life.

4. A measurement of the finish that is left on the cut surface for various metals under standardized conditions.

5. The penetration of a standardized drill rotating at definite speed and under uniform load when cutting various metals.

6. The torque developed by a drill while drilling various metals under standardized conditions.

7. A cutting speed for certain tool life expressed in terms of tensile strength, reduction of area, or percentage of elongation of the various materials.

8. The hardness numbers of the materials as indicated by a hardness testing machine.

9. The measurement of heat generated and hardness induced by the cutting process.

In the above methods where various metals are being compared, the conditions should be so standardized that the material being tested is the only variable. In some instances, such as measuring the cutting temperatures, forces involved, etc., for a given material as a function of the speed or size of chip, elements other than the material may be varied.

The work of many authors was referred to in the paper, and their conclusions on certain phases of machinability presented. These works involve different methods and standards, which in many cases made comparisons difficult. The author says it would be well if the various methods of testing machinability could be compared by direct data from the test bars so as to find if the torque or the feed in inches per 100 revolutions of the drill, or the force, power, tool endurance, or Taylor-Speed, etc., in straight line cutting or turning; the energy absorbed by a milling cutter, etc., have anything in common.

Steel and Machine Tool Exposition Displays New Products

American Society for Steel Treating holds ninth annual show in Detroit. Philadelphia to be site of next exhibit.

THE ninth annual steel and machine tool exposition was held at Convention Hall, Detroit, last week, by the American Society for Steel Treating. The number of exhibitors and the floor area covered by exhibits were larger than in any previous year and the attendance was very satisfactory, much interest being shown in the various displays.

The exposition, although all in one building, comprised three distinct divisions. Upon passing through the main entrance on Woodward Ave. one first came into the machine tool section. In the rear of the building was the steel and heat-treating exposition and at one side the exposition of welding equipment. While not all of the large machine tool makers were represented, the display was quite extensive and variegated.

In the welding equipment section fusion welders and cutters and supplies for the welding trade were shown by more than forty exhibitors. Many of the welders were shown in operation.

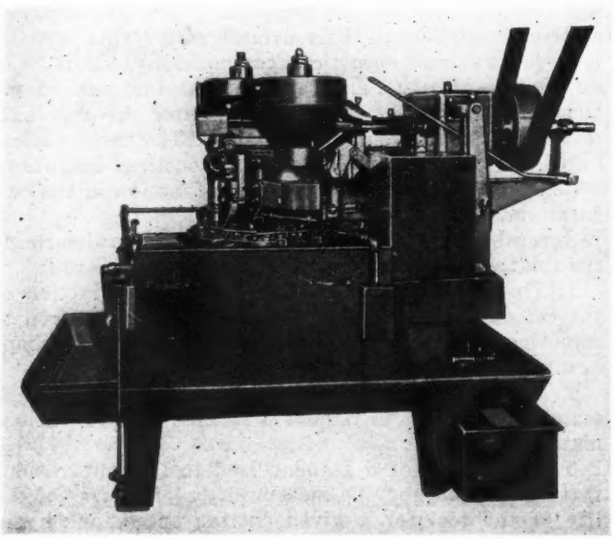
The largest proportion of the more than 300 exhibitors were in the steel and heat-treating division. Most of the large steel makers were represented by exhibits, as were makers of ovens, refractories, carburizing and quenching materials, mechanical and other testing equipment, heat-control equipment, etc.

Next year the show will be held in the Commercial Museum, Philadelphia, Oct. 8-12, where 77,000 sq. ft. of floor space is available. This was announced at the business meeting of A. S. S. T. held at the Statler Hotel. The name of the exposition is to be changed to the National Metal Exposition to tie it up with National Metals Week, which will again be held at the same time.

Among the new tools exhibited at the show was the Melling Mill-Drill-Matic, manufactured by the Ampco Twist Drill Co., Jackson, Mich. This was shown in two designs, Nos. 1 and 3. The former is a smaller machine and performs milling, drilling, "burring" and tapping operations consecutively, while the No. 3 machine performs them simultaneously and therefore has a larger output. The No. 3, which is undoubtedly of most interest from the automotive production standpoint, is illustrated herewith. The operations enumerated can be performed on parts requiring a drill of not over $\frac{3}{8}$-in. diameter and can be performed at one setting.

The machine has a work dial which automatically indexes from station to station and locks in position, making it rigid as the bed of the machine itself. Above the dial are two vertical spindles, for drilling and reaming respectively, and two milling units for rough milling and finish milling respectively.

The first position is that of rough milling. The milling cutters automatically advance and retract, removing all stock except a few thousandths on each surface. This provides flat surfaces for the support of the piece and starting of the drill. The next position is that of drilling. At this point the work has indexed over a

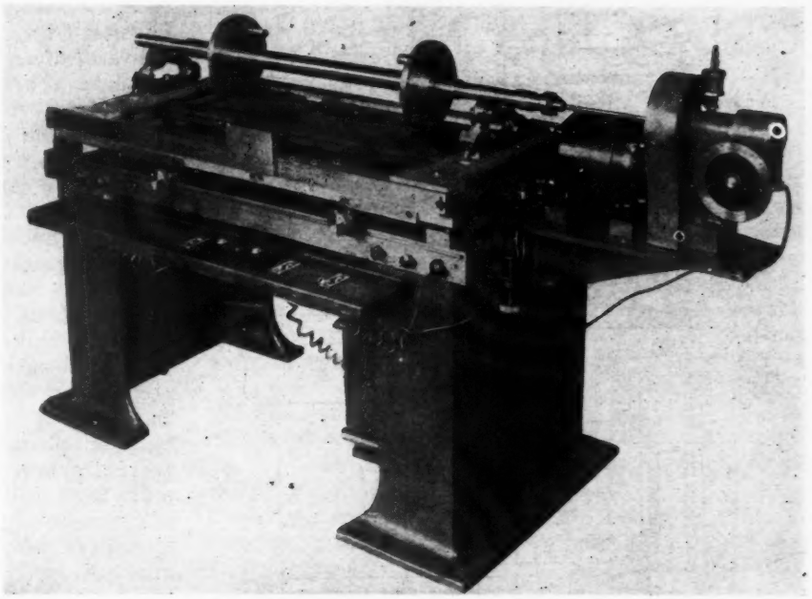


Melling Mill-Drill-Matic

hardened rigid support which permits no shifting in the holder from the pressure of the drill.

The third position is that of finish milling, the remaining few thousandths on each being removed, together with the burr caused from the drilling operation. Finally the work is indexed over a second rigid support and the hole is reamed to size. The machine is fully automatic in its operation, the operator merely inserting the work and removing it when finished. It may be conveniently stopped or started at the will of the operator. On S.A.E. standard yoke ends the production rate is 650 per hour on the ⅜-in. size, 750 per hour on 5/16-in. and 850 per hour on ¼-in. size.

A new type of Olsen-Lundgren dynamic balancing machine was shown by the Tinius Olsen Testing Machine Co. of Philadelphia. It is designed to determine the angle and amount of unbalance at each end of relatively long rotating parts. The part to be balanced is placed on roller supports on a horizontal frame which is capable of rocking or vibrating around a pair of knife edges near each end and is driven through a flexible shaft from a small motor mounted on a bracket at one end of the base. When a test is made one set of knife edges is lowered so that the vibrating frame is supported solely by the other set and any vibration due to unbalance of the part under test must occur around it. Such vibration causes a pair of electric contacts at the end of the frame to close a circuit periodically, and as a consequence a spark passes between a rotating arm and a dial at the right of the machine. Note is made of the point of the dial at which the spark occurs.



Olsen-Lundgren dynamic balancer

The machine is stopped by means of a push switch and is turned by hand until the rotating arm points to the part of the dial where the spark occurred. The unbalance is then on the lower side of the part being tested. Next the machine is started up again and a weight on a scale beam in the front of the machine is shifted until sparking occurs uniformly all around the dial. The amount of the unbalance in oz.-in. is then read off from the scale beam. The same operations are then repeated for the other end of the rotating part. This machine is being built in various sizes.

The Hutto Engineering Corp. of Detroit, exhibited new model of its grinder designed specially for grinding out the holes of piston bosses and the cylinders of hydraulic brakes. It is known as Model G, and its capacity covers holes of from ¾ to 1½ in. diameter. A large size of the same type of grinder, for grinding out the liners of Diesel engine cylinders, was also shown.

A grinding and polishing machine of the belt type and based on the centerless principle was exhibited by the Production Machine Co. of Greenfield, Mass. Cylindrical parts such as piston pins, knuckle pins, and steering columns, are passed between two belts carrying abrasive or polishing material. The two belts run at an angle to each other, whereby an automatic feed is obtained. This machine comes also with a taper attachment, making it possible to polish in it such parts as cane-type gear shift levers.

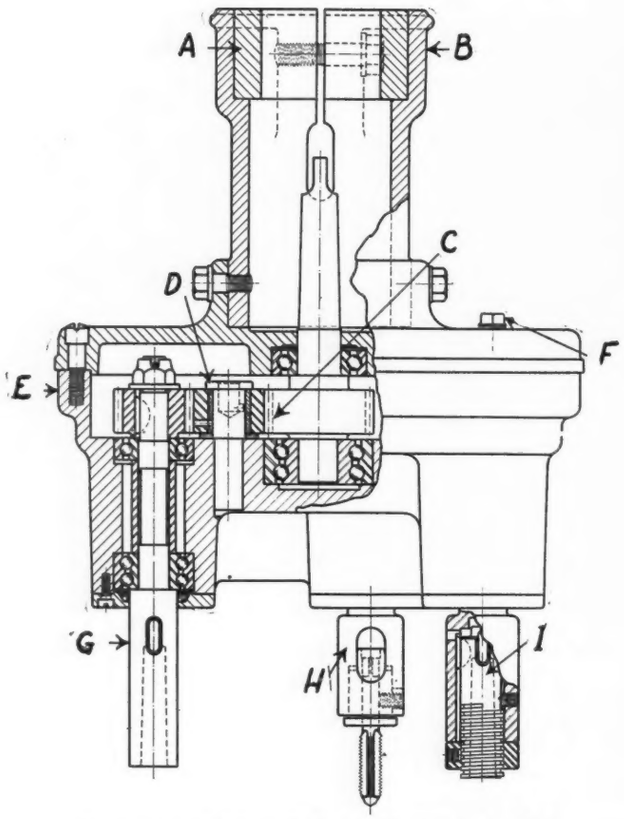
The Cooper-Hewitt Electric Co. showed a work inspection table illuminated by means of Cooper-Hewitt electric mercury vapor lamps under an inverted trough-type of reflector. A scientific novelty at this booth consisted in a mercury vapor lamp suspended over a box containing a generator of high frequency waves. When the bulb was directly over the axis of the box or over the axis of the high frequency coil therein, it lit up, while when moved slightly to one side it became extinguished.

Another device shown on the Cooper-Hewitt stand was the Kon-nec-tor, a mercury switch for use in connection with sign flashers, time clocks, motor controls, heat-control devices, thermostatic switches, etc. It consists of a short closed glass tube containing a small amount of mercury, into the lower side of which are welded two solid metal contacts. When the tube is in the horizontal position or nearly so the mercury covers both contacts and establishes the circuit, whereas when it is tilted to one side the circuit is broken. An advantage of these switches is that it requires very little energy to operate them, hence they are very sensitive. The tubes are filled with an inert gas, which prevents oxidation.

A considerable variety of metal-cleaning equipment was shown, including one machine by Ideal Industrial Machinery of Cincinnati, which is somewhat suggestive of a concrete mixer, comprising a revolving drum into which the parts to be cleaned are introduced through an opening in the end, by means of a chute which is hoisted into the discharging position.

An improved type of the Hopkins compressed air chuck was shown by the Tomkins-Johnson Co. of Jackson, Mich. The air valve for these chucks is now located on the air cylinder at the outer end of the headstock, and the control lever, which is located convenient to the operator, is connected to the valve through a linkage. Formerly the valve itself was located convenient to the operator and it was necessary to run a pair of pipes to and from the valve parallel with the headstock. These pipes are now eliminated.

Charles Engelhard, Inc., of Newark, N. J., has made an improvement in the method of suspending the movable element of its indicating and control instruments.



Krueger multiple spindle drilling and tapping head

A flexible metal suspension is used to which the movable element was formerly soldered. This resulted in a weak spot or a concentration of stress near the soldered point. Now a mechanical or wedge joint is employed which eliminates this weak spot and permits of the use of a much finer suspension, thus adding to the sensitivity of the apparatus.

The Detroit Sheet Metal Works showed a model of a core oven of which about a dozen have been installed in the Buick plant in Flint. This comprises a vertical chain conveyor 38 ft. high. Containers made of sheet metal and with a screen wire bottom are suspended from cross bars of the conveyor to receive the cores. These ovens have a horizontal section of 6½ by 8 ft., contain 26 trays and are of the continuous type, cores being loaded in at the bottom at one side and removed at the other. The cores remain in the oven about 3½ hours.

The Taylor Instrument Co. of Rochester, N. Y., exhibited a new indicating controller for spring drawing ovens, core baking ovens, enameling ovens, etc. It is of the capillary bulb type and combines an indicator with a controller in one unit. There are three electric terminals on top of the instrument, for the common, the low temperature, and the high temperature wires respectively, from which connection can be made either to solenoid-operated or motor-operated valves. The temperature limit of the device is 950 deg. Fahr.

The Shore Instrument & Mfg. Co. of Jamaica, N. Y., has shortened its Type D instrument so as to make it available for taking measurements inside of tubes of from 6½ in. diameter up. This company also exhibited a new hardness testing instrument based on the indentation principle and known as the Monotron.

The Westinghouse Electric & Mfg. Co., in its exhibit in the welding section showed as a new product a motor generator set for welding purposes. This set operates on alternating current of either 220 or 440 volts and delivers direct current, with open circuit voltages regulatable between 40 and 100 volts. By means of a single hand-wheel control the output can be varied between 40 and 400 amp. An ammeter and a voltmeter for the direct current side are built into the machine. The set is mounted on three metal wheels and is therefore portable. It is started by means of a button switch, and has under-voltage and over-load protection. A stabilizing coil in series with the welding leads is mounted on the under side. The weight is 1500 lb.

H. R. Krueger & Co. of Detroit, showed ball-bearing, auxiliary multiple spindle drilling and tapping equipment. One such multiple spindle head is shown in partial section herewith. The clamp bushing A inside the holding sleeve B is bored to fit any size of drill press. The various spindles are driven through alloy steel, heat-treated gears C, some of which are mounted on idler studs D. These gears and the mountings for the spindles are contained in a housing E of either cast iron or aluminum, provided with a grease plug F. The standard spindles G are of alloy steel and are mounted in ball bearings, the inner races of which are locked to the shoulders of the spindle by means of a spacing sleeve and nut. At H is shown a tap spindle which is mounted the same as the drill spindle. The floating holder allows the taps to cut freely. At I is shown an adjustable sleeve spindle which, by means of a fine thread adjustment, can be quickly set to the desired depth.

Institute of Metals Talks About Aluminum

OF the papers presented to the Institute of Metals (a section of the American Institute of Mining and Metallurgical Engineers), which also met in Detroit last week, those relating to aluminum and its alloys are of particular automotive interest. R. L. Templin, chief engineer of tests, Aluminum Co. of America, presented a paper on "Machining Aluminum." He pointed out in his introduction that problems which have arisen in the automotive and airplane industries have emphasized the need for a better understanding of the machining properties of this metal and its alloys.

The front clearance of a tool for machining aluminum and its alloys should be about 6 deg., and the top rake from 30 to 50 deg., making the total angle of the cutting edge from 36 to 56 deg. A side rake of from 10 to 20 deg. is recommended.

While lathe tools may be forged of rectangular section tool steel and given the proper angles, the maintenance of the latter requires considerable grinding, and it is preferable to use a tool as shown on page 510. The bit is made of annealed high carbon or high-speed steel rod stock, properly hardened and tempered. Resharpening is easily accomplished by holding the bit by its shank in the chuck or collet of a tool-grinding machine and grinding off the outside diameter until a keen edge is obtained on the bit. After each grinding the tool should be stoned by hand with a fine or very fine oil stone, taking care that neither the angles nor the contours of the cutting edges are appreciably modified by the stoning operation.

These tools tend to produce a continuous chip which is usually curled only a little. Decreasing the top and side rake angles curls the chips more and tends to break them up. Pure aluminum and many of its alloys

are capable of being machined to a mirror-like surface, but this is easily scratched by the chips, which are work-hardened.

Parting tools should have from 12 to 20 deg. top rake and should be stoned to a keen and smooth cutting edge. The front clearance angle should be only 3-4 deg. Facing tools should be ground to have a side rake equal to the top rake of outside turning tools.

Circular forming tools as used in automatic screw machines are sometimes difficult to design so that they will machine aluminum and its alloys properly. Best results are obtained in such cases by using a roughing tool first and following with a very light finishing cut with the forming tool.

Milling cutters, straddle mills, and mills and similar cutters work to best advantage in aluminum if they are of the coarse tooth spiral type and have a considerable amount of top rake on their cutting edges. Milling cutters with nicked teeth sometimes reduce the chip size. Good results may be obtained also from face milling cutters with inserted teeth, helical milling cutters and staggered tooth milling cutters, provided only the top and side rakes are in accordance with the rules given.

Aluminum on account of its lower modulus of elasticity, recovers more than steel after the tapping operation, and for this reason it is advisable to use taps that are slightly over-size. Thread chasers for self-opening die heads and collapsible taps should be made with considerable top and side rake.

The ordinary twist drills are not suitable for use in aluminum. In some cases a single-fluted twist drill as used for hardwood has given satisfactory results, but a better drill for aluminum is one having flutes of greater spiral angle, that is, with more twist per inch of length (say 47 deg. of spiral angle). Reamers of the spiral-fluted type give the best results.

Saws for cutting aluminum should be of the coarse-tooth type and have some top rake on the teeth. Saws used for cutting hardwood often work well in aluminum when used with a lubricant. Hand hacksaw blades of the "wavy-set" type also give good results. Files for use on aluminum must have coarse teeth, which limitation, however, does not seem to apply to the recently introduced chromium-plated files.

Cutting speeds as high as 500 to 800 ft. p. m. are possible in some instances even with carbon steel tools, and appreciably higher with high-speed steel tools. Feeds may vary from a few thousands for finishing cuts to ¼ in. for roughing cuts.

Automobile and Aircraft Production Get Attention From Welders

Talks at meeting of American Welding Society show how this art is contributing to modern production advances in industry.

THREE of the papers read before the American Welding Society in Detroit dealt with automotive subjects—two with welding in aircraft production and one with welding in automobile manufacture.

J. B. Johnson, chief of the Material Branch, War Department Air Corps, McCook Field, had for his subject "Welding the Aircraft Structure." Mr. Johnson said that fuselages, tail planes and landing gear are now generally built up of tubular members that are welded together by means of the oxy-acetylene torch, a form of construction introduuced by Anthony Fokker of Holland.

In the fuselages and other parts of military air planes chrome-molybdenum steel tubing is now used almost exclusively. The tubing used varies from ¼ to ½ in. in diameter and in wall thickness from 0.021 to 0.065 in. The material contains 0.25-0.35 per cent carbon; 0.80-1.10 per cent chromium; 0.40-0.60 per cent manganese, and 0.15-0.25 per cent molybdenum, and it has a tensile strength of 95,000 lb. p. sq. in. and a yield point of 60,000 lb., as compared with 55,000 and 36,000 lb. for carbon steel. The alloy steel welds well and has the further advantage that it is slightly air-hardening when cooling from the welding heat. In fact there is practically no loss of strength in the tubing due to the welding, whereas low carbon steel shows a loss in ultimate strength of from 54,000 to 44,000 lb. due to this cause, and a loss in elastic limit of from 34,000 to 22,000 lb. p. sq. in. With medium carbon (0.23-0.29) steel the loss of strength due to heating in welding is smaller.

Another advantage of alloy steel tubing is that its physical properties are more nearly uniform than those of commercial carbon steel tubing.

A few rules with respect to the design of welding joints have been adapted by the Air Corps. For a straight butt weld a tensile strength of 80,000 lb. is allowed in calculations with tubing having a tensile strength of 95,000 lb. If the joint has a fishtail form or is reinforced by gusset plates, the value may be increased and designs have been approved that were based on a tensile strength of 95,000 lb. In designing cluster joints overlapping of welds must be avoided as far as possible. For any single cluster 80,000 lb. can be figured on if there are not more than six tubes to the cluster, otherwise the figure should be reduced to 60,000 lb. Welded joints are low in ductibility and should not be made to support a transverse load unless reinforced.

In the construction of aircraft material is sometimes welded after heat treatment without any reheat treatment. For the part not affected by the welding heat the physical properties of the material as quenched and drawn are figured with, while for the part so affected the properties of the normalized material are used. For this material it is generally assumed that the effect of the welding heat extends to ¼ in. beyond the seam. This permits of welding high-strength heat-treated lugs to a tubular structure in locations where heat treatment

after welding is impractical.

Tubular aircraft structures are welded up in jigs. All welded structures are subjected to static load tests, the loads imposed being equal to the maximum live loads that can occur in service multiplied by a certain arbitrary factor of safety. Even under this severe test a weld seldom fails. The landing gear, which is also welded up, is subjected to an impact test by being attached to a fuselage or frame and dropped from a certain height onto an inclined plane.

Welded structures not only have proved more durable than equivalent structures but they are also easier to repair. However, parts of the structure which derive their strength in part from cold working or heat treatment should not be repaired by welding. Brazed or soldered joints should never be repaired by welding as the elements of the solder and brazing spelter form very brittle alloys with the fused steel and produce blowholes and defective joints.

Preventing Misalignment

Members subjected to direct bending or tension stresses, if spliced by welding, should have the splices reinforced by riveting, priming or telescoping. Where fishtail joints are used the included angle should be 60 deg.

Misalignment due to expansion and contraction during welding can be prevented by the use of wooden struts with notches in the ends to hold the tubes in place.

The paper by Mr. Maylor, chief engineer, Stinson Aircraft Co., Detroit, on "Welding in Aircraft Construction," was along the same lines as that of Mr. Johnson. Mr. Waylor is the designer of the "Pride of Detroit" which started on a world flight some time ago and his talk dealt with the practices followed in building the parts for this and similar planes. It appears that the fuselages of commercial airplanes are built up mainly of medium carbon (0.25-0.30) steel and chrome molybdenum steel tubing is used only for the more highly stressed parts. The alloy steel is used for the engine mounting, as well as for the tail skids and the landing gear. These three parts are those that give the most trouble in practice and they are all made of the alloy tubing, whereas the less highly stressed members are made of carbon steel tubing for the sake of economy. For the control members push-pull tubes have generally replaced the cables formerly made. These are supported in self-lubricating graphite bushings in the fuselage frame at short distances.

Reasons for Failures Argued

The discussion of these two papers centered to some extent around the reason for failures with overlapping welds. One member expressed the opinion that if the original weld were sand-blasted before welding over it, so as to remove all traces of oxidation and dirt, such an overlapping weld would be stronger than a single weld, but frequently this was not done and the film of iron oxide on the surface would prevent a firm bond being obtained. There was also some discussion on the practice of introducing oil into welded-up tubular members to prevent internal corrosion. The Air Service is now using linseed instead of mineral oil, as the former will close up any small leaks in the weld, while with the mineral oil it was necessary to apply an enamel to the outside to prevent leakage. The objection to the oil is that when making repairs by welding it not only causes annoyance from smoke but makes it difficult to secure a clean metallic surface.

W. C. Happ of the Studebaker Corp. in his paper on "Welding of Automobile Parts," dealt with the subject in a general way largely. The reason welding is widely used in automobile manufacture is that it permits of fabricating light and strong assemblies at relatively low cost. For each application a thorough study should be made as to which form of welding is best adapted for the purpose. Great care should be bestowed also upon the design of the jigs, which must hold the parts firmly, be easy and rapid in operation and not too expensive.

One point developed at some length was the building up of the welding department personnel. Two methods are available. Either experienced welders who learned their trade elsewhere may be hired, or the company may conduct a school and train its welders itself. In hiring welders it is well to test them on some job requiring a fair degree of skill, because many who believe they are skilled welders are under an illusion. The Studebaker Corp. has used both methods and in its school it gave instruction to about 500 men in the course of one year. Such a school can be made practically self-supporting in a large plant by fabricating such articles as small tanks, cabinets, tool boxes and tote boxes largely from scrap steel, and performing salvage operations on small castings and stampings. Giving the men work of this kind helped to maintain their interest in the school better than when working on mere practice welds.

Floor Supervision Urged

It is a good plan to have a floor supervisor, a man thoroughly familiar with the particular class of work being done, whose duty it is to look at each welding operation at least once a day. In the gas welding department this man selects the size of tip to be used for each job and he sees to it that the operator does not use a larger tip or bore out the selected one; he also sees to it that no excessive gas pressures are being used. In the electric welding department the floor supervisor sees to it that the correct voltage and amperage are used in arc welding, that the dies used for the butt welding of panel seams are properly set, that spot welders are correctly set and that the inspectors make satisfactory tests of the welds. Where welding operators were under foremen who had no practical experience in welding themselves, the latter were given a week in the welding school. This resulted in a marked improvement.

One difficulty experienced in the gas welding department is due to lack of standardization, three different makes of gas apparatus being used by the Studebaker Corp. This made it necessary to provide floor supervisors with a chart showing the differences between tip holes and threads of the different equipments.

Welding wire is tested in the Studebaker plant as follows: Samples of 11-gage metal are welded on both sides—by the same operator, the same torch and with the same pressure—the excess metal is then carefully ground off, so that the cross-sections of the pieces are identical, and the test pieces are then pulled in the standard laboratory machine for strength. By this method the company has succeeded in getting good welding wire without paying the top price. Efforts are being made also to minimize the number of sizes of wire required.

While the welding school was in operation sheet metal boxes were made, each holding a complete torch and regulator equipment. Welders were required to dismount their regulator, gas saver and torch each evening, place them in the metal box and deliver same to the tool crib.

Later it was found that many repairs to the regulators were called for by dirt in them, which could get in only when the regulator was disconnected. By equipping each regulator with a plug, secured to it by a chain, and requiring the operator to screw the plug into the regulator every time he disconnected it, these repairs were reduced by 50 per cent.

It is difficult to properly inspect a weld without destroying it, and it was found a good plan to give the weld inspectors a course of instruction to enable them to make tests more intelligently.

For a difficult welded assembly in the Studebaker car, comprising the shroud panel, pillar and shroud cross-bar, a special test was evolved whereby the seam is subjected to repetition stresses of a certain value. After experimentation a certain number of repetitions of the stress was selected as the minimum which the weld must withstand without opening up. A certain proportion of the assemblies welded by each operator are subjected to the test, and a report on each operator's work is made each week, all results being published in the form of a chart. This not only gives the management a line on the results it is getting but greatly improves the results by stimulating the men to better effort.

Among other things taught in the welding school, pupils are told how carbide and acetylene gas are manufactured and what oxygen is and how it is obtained, and operators are impressed with the fact that both gases are expensive products and must not be wasted.

The discussion of this paper was rather limited because of the limited time available. One of the men present asked the author how he overcame the trouble from roughness or depressions due to spot welding of body panels. The question was answered by a welding engineer of the Studebaker Corp., who said that by using on the side of the sheet which it is desired to keep smooth, a die with a circular depression from 0.006 to 0.008 in. deep, the metal will fill this depression when the weld is being formed and will recede due to contraction during cooling, thus leaving a smooth surface. The other side, of coures, will have depressions due to the pressure of the electrode.

Tire Simplification Program is Urged By Department of Commerce

WITH the question of standardization of tires sizes still unsettled and claiming the attention of many in the industry, a recent bulletin sent out by Ray M. Hudson, Chief of the Division of Simplified Practice, Department of Commerce, contains some interesting information. Mr. Hudson has compiled two lists showing, respectively, the 10 most popular tire sizes supplied to car manufacturers since 1924 and the 10 most popular sizes supplied to dealers and the export trade. Comparative popularity has been based on sales volume.

These two tables are shown herewith. Mr. Hudson, in discussing them, points out that only three tire sizes have been among the first ten supplied to car makers since 1924. These are the 31 x 5.25; 33 x 6.00 and the 30 x 5.25. Since 1925 the 29 x 4.40 has held first place and since 1926 the 29 x 4.75 and 32 x 6.00 have increased in popularity. These sizes, according to Mr. Hudson, seem a logical basis upon which to rest a simplification program.

About 80 per cent of total production is confined to five sizes. Mr. Hudson suggests that the automotive industry might still further add to its prestige as the most progressive of American industries by cooperating with the 200 tire manufacturers, the 100,000 tire dealers and the 22,000,000 motorists in instituting a simplification program.

Ten Most Popular Tire Sizes as Indicated by Volume of Sales for 1924-1927
TO CAR MANUFACTURERS

	1924	1925	1926	First five months of 1927
1.....	29 x 4.40 (499,526)	29 x 4.40 (1,262,874)	29 x 4.40 (2,652,486)	29 x 4.40 (1,862,915)
2.....	31 x 5.25 (131,841)	30 x 5.77 (316,992)	31 x 5.25 (690,380)	31 x 5.25 (417,463)
3.....	31 x 4.40 (81,305)	31 x 5.25 (284,239)	33 x 6.00 (400,114)	33 x 6.00 (275,914)
4.....	32 x 6.20 (76,297)	31 x 4.40 (153,210)	30 x 5.77 (368,804)	30 x 5.25 (158,135)
5.....	33 x 6.20 (48,720)	32 x 6.20 (138,881)	30 x 5.25 (289,454)	30 x 5.77 (151,289)
6.....	33 x 4.95 (38,984)	33 x 6.00 (133,949)	30 x 4.95 (193,150)	31 x 5.00 (107,439)
7.....	31 x 4.95 (36,499)	30 x 4.95 (132,225)	32 x 6.20 (147,873)	32 x 6.00 (98,617)
8.....	30 x 5.77 (29,846)	31 x 4.95 (106,601)	30 x 4.75 (142,567)	29 x 4.75 (96,023)
9.....	32 x 5.77 (29,472)	32 x 5.77 (103,603)	31 x 4.95 (116,682)	30 x 4.75 (89,312)
10.....	34 x 7.30 (26,810)	30 x 5.25 (79,277)	29 x 4.75 (110,962)	30 x 4.95 (76,816)

Ten Most Popular Tire Sizes as Indicated by Volume of Sales for 1924-1927
TO DEALERS AND EXPORT

	1924	1925	1926	First five months of 1927
1.....	31 x 5.25 (386,807)	29 x 4.40 (4,023,647)	29 x 4.40 (5,238,997)	29 x 4.40 (2,341,120)
2.....	30 x 5.77 (292,685)	30 x 5.77 (1,208,455)	31 x 5.25 (1,603,783)	31 x 5.25 (561,053)
3.....	32 x 5.77 (208,385)	33 x 6.00 (1,050,887)	33 x 6.00 (948,916)	29 x 4.75 (359,042)
4.....	32 x 6.20 (199,929)	31 x 5.25 (912,370)	30 x 5.25 (721,422)	31 x 5.00 (396,614)
5.....	31 x 4.95 (158,730)	30 x 4.95 (649,522)	30 x 4.75 (547,076)	33 x 6.00 (220,087)
6.....	33 x 6.20 (114,337)	30 x 5.25 (443,801)	29 x 4.75 (414,672)	32 x 6.00 (200,655)
7.....	33 x 6.00 (96,595)	29 x 4.95 (326,962)	30 x 4.95 (335,145)	28 x 4.75 (179,997)
8.....	30 x 5.25 (90,810)	32 x 6.20 (279,874)	30 x 5.77 (197,197)	31 x 6.00 (151,388)
9.....	34 x 7.30 (45,107)	32 x 5.77 (261,609)	32 x 6.00 (187,551)	30 x 5.25 (133,672)
10.....	33 x 5.77 (32,430)	33 x 6.75 (154,067)	27 x 4.40 (131,366)	30 x 6.00 (94,618)

AUTOMOTIVE NEWS SECTION INDUSTRIES

Philadelphia, Pennsylvania

Saturday, October 1, 1927

Output for Year Indicated 15 Per Cent Under 1926

PHILADELPHIA, Oct. 1—It is now indicated that the automotive production this year will be around 15 per cent under the record-breaking year of 1926. This is approximately the rate at which the industry fell below in the first eight months of the year and the prospect that Ford production will add little to the total until the closing weeks of the year does not promise a very large fourth quarter.

The falling off in volume has been mainly in the passenger car field. Production of cars and trucks for eight months was 2,743,411 units against 3,237,933 in the corresponding period of 1926, a drop of 494,522 or 15.3 per cent. Cars alone, however, fell 17 per cent, or to 2,407,297 units against 2,896,148 last year. Trucks and buses fell only 1.6 per cent to 336,114 units against 341,788.

The drop in car production was mainly at the expense of Ford, the majority of other producers, large and small, recording gains for the eight months.

Just now production is undergoing seasonal decline and the sales situation is unusually confused, with some territories reporting sharp drops from the August level and others on a level that compares favorably with last month and with the same period a year ago. Generally speaking, business is proving hard to get and factories and sales organizations are in a tense struggle to maintain volume.

Clean Deals 29 Per Cent of Reo Sales in August

LANSING, Sept. 28—Reo Motor Car Co. reports sales at retail in August as four times larger than in August, 1926. Of this business 29 per cent represented sales with no trade-in involved. August deliveries included 2152 Flying Clouds and 741 Wolverines, of which 582 and 259 respectively were clean deals. Sixty-four makes were represented in the Flying Cloud trades and 50 makes in Wolverine deals.

Quarter Shipments Seen Higher

DETROIT, Sept. 28—The Great Lakes Regional Board indicated today that 18 to 20 per cent more freight cars will be needed to move automobile shipments in the last quarter this year than in the 1926 last quarter.

Jordan Orders 90 Days Ahead

CLEVELAND, Sept. 26—Edward S. Jordan, president of Jordan Motor Car Co., says the company has orders which will keep it busy for 90 days following the announcement of the new Air Line Eight.

Willys Takes Over Body Making Dec. 1

TOLEDO, Sept. 27—Manufacture of all bodies for Willys-Overland cars within the company's own plant here will be in full swing by Dec. 1, when the new $300,000 body plant will become available for use, it was announced today by President John N. Willys. For many years the company has purchased a portion of its bodies from independent body builders. Economies and closer inspection will result from the new plan. Mr. Willys indicated the company would be able to save several million dollars a year through its operations in the body field.

To Start Assembly in Germany

NEW YORK, Sept. 28—Sailing for Europe this week, Sir William Letts, managing director of Willys-Overland-Crossley, Ltd., said assembly operations of Whippet and Willys-Knight cars would soon be started in Berlin. Plans are being made also for assembly in the Scandinavian countries, and separate organizations have been formed in Antwerp and Germany.

Ford of Canada Reports $5,341,177 Profit in 1926

NEW YORK, Sept. 28—Net profit of Ford Motor Co. of Canada, Ltd., for the year ended Dec. 31, 1926, totaled $5,341,177 after depreciation, Federal taxes, plant write-off, etc., excluding certain rebates which may be received at a later date. This is equivalent to $76.30 a share on 70,000 shares of stock. The previous report covered five months ended Dec. 31, 1925, the fiscal year having been changed at that time, and showed net profit of $974,316.

Safety Council Meets

CHICAGO, Sept. 28—The National Safety Council opened its sixteenth annual safety congress at the Stevens Hotel this week with about 5000 persons in attendance. Conditions in the automotive industry were under consideration Tuesday.

Australia Increases Automobile Tariffs

NEW YORK, Sept. 28—Cable advices from Australia received here report the introduction of an amendment to the tariff increasing the intermediate and foreign duties on automobiles by 5 and 8 per cent respectively. The preference rate on cars of British origin continues unchanged.

Hough Goodrich Head; D. M. Goodrich Chairman

AKRON, Sept. 28—Harry Hough, vice-president and comptroller of the B. F. Goodrich Co. for the past 10 years, has been elected president to succeed the late Bertram G. Work. The board of directors at its special meeting also named D. M. Goodrich, son of Dr. B. F. Goodrich, founder of the company, as chairman of the board. J. D. Tew, works manager, was named first vice-president and a member of the executive committee, filling the vacancy left by the death of L. D. Brown.

G. M. Jett was named secretary to succeed F. C. Van Cleef, resigned. T. G. Graham was named works manager.

The realignment leaves Goodrich with three vice-presidents: W. O. Rutherford, in charge of sales; C. B. Raymond and J. D. Tew. D. M. Goodrich has been a large stockholder in Goodrich, but until now was never an officer.

General Electric Lowers Mazda Lamps Prices 27%

NEW YORK, Sept. 26—A price reduction in Mazda lamps for use in automobiles, averaging 27 per cent, is announced by Gerard Swope, president of the General Electric Co. This will amount to approximately 10 cents for each headlight lamp and 5 cents for most rear, side and instrument lamps.

Aside from economies effected by improved methods of manufacture, Mr. Swope said, changes in construction have been accomplished tending to reduce glare and to make night driving easier. One of these is the use of the corrugated headlight bulb, eliminating unnecessary filament reflections.

John Ford

DETROIT, Sept. 28—John Ford, younger brother of Henry Ford, died suddenly of heart disease in the village of Fordson near here. He was 62 years old and a member of a real estate firm. He is survived by Henry, another brother, William, and a widow and three children.

Accounting Division G.M. Greatest Move

Stabilization to Result From Dealer Aid, Says Sloan—Not Fighting Ford

DETROIT, Sept. 28—A. P. Sloan, Jr., president of General Motors Corp., made his first public statement on the General Motors accounting subsidiary in an address to automobile editors of the country at the Milford proving grounds today. Mr. Sloan said the subsidiary had been organized and that it would establish proper accounting systems wherever desired by General Motors dealers. The successful operation of this subsidiary will be the greatest achievement of General Motors he said.

Referring to newspaper statements of a forthcoming test of supremacy with Ford, Mr. Sloan said that both Ford and General Motors are governed by the same economic principles—to give the greatest possible value in their respective price classes. General Motors idea, he said, was to make a car of greater luxury than the Ford—a car that properly belongs to the next higher price class.

Of the dealer accounting subsidiary, Mr. Sloan said in part:

"We have organized a subsidiary whose sole function will be to establish proper accounting systems wherever desired by our dealers. We will audit such accounts periodically in order that our dealers may have the assurance that their records are properly established and that the facts that come to them are facts rather than fiction. We feel that with the great amount of specific knowledge we have, involving all phases of the automotive business, and with an organization that specializes in this particular branch of accounting, with nothing else to think of, that we can, through evolution and with the cooperation of our dealers, place before them facts and figures that will indicate to them very clearly what they should do and what they should not do.

Will Promote Confidence

"I do not think there is anything that will contribute more to our complete stabilization than an accomplishment of this kind. I do not think there is anything that will establish greater confidence in the minds of the banking interests whose cooperation we must have in carrying on. Some time ago I saw it stated, and I believe it is absolutely correct, that if business, using that term in its broadest sense, were equipped with proper accounting, a very large percentage of the failures and losses incident to same, could be eliminated. We hope to be able, in due course of time, to place before our dealers 'bogeys' I might say, showing the proper relationship of each expense item to the business as a whole with the result that if a dealer will conduct his affairs along the lines that we can ultimately outline to him, he will, in a sense, take the straight and direct course to a reasonable and fair profit.

"I have told my associates time and time again, that with this program of ours accomplished to the degree that I am hopeful that it can be accomplished, it will be the greatest achievement of General Motors."

Dawson Heads G. M. Fleet Sales

DETROIT, Sept. 28—C. Earl Dawson will head a new department to handle fleet sales for General Motors Corp. In taking up his new duties Mr. Dawson retires as assistant sales manager of Chevrolet, with which company he served for 15 years. Mr. Dawson's new department will handle both commercial and passenger fleet sales.

Lancia to Assemble Cars in U. S. Plant

NEW YORK, Sept. 28—Lancia Motors of America, Inc., has been chartered in New York with a paid-in capital of $1,000,000 for the manufacture and sale of a new Lancia car in the United States. The engine, transmission and differential will be manufactured by the Lancia Automobile Co. of Turin, Italy, but other parts units will be of American manufacture and assembling of the complete job will be done here. Negotiations for an assembling plant with capacity of 20 daily are now under way.

The American car will be of 128-in. wheelbase and the engine an eight-cylinder monobloc V-type. Although prices have not been definitely established, the four or five body types in the regular line will sell for around $3,500, representing a large saving under the cost of importing a complete car.

The Italian company has joined with American capital in the formation of the American company. Vincent Lancia will be chairman of the board of Lancia Motors of America. It is understood that Anthony Flocker, who has represented Lancia in the country for some time, will be president. Besides Mr. Flocker, incorporators of the new company are M. F. Longo and J. A. Pinton, all of New York City.

Fisher and Bitting Take Places on Baldwin Board

PHILADELPHIA, Sept. 29—Membership of the board of directors of Baldwin Locomotive Works was increased from 12 to 15 at a special meeting today and Fred J. Fisher and C. R. Bitting, representing Fisher stock holdings, were selected to fill two of the three new places. Mr. Bitting later will become a member of the finance committee. The third new director will be selected in the near future.

Business in Brief

Written exclusively for* AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co.

NEW YORK, Sept. 29—As measured by the principal indexes of business activity, little change in the fundamental situation has developed in the past week. Retail sales have been stimulated by more favorable weather, though wholesale trade has responded to a lesser degree. Crop prices were mixed during the week. Prices for corn and grain advanced, while cotton was slightly lower.

FREIGHT CAR LOADINGS

Railroad freight car loadings in the week ended Sept. 10 reflect the appearance of the Labor Day holiday, numbering 989,472, as compared with 1,117,069 in the previous week and 1,024,998 in the like period a year ago. Total loadings so far this year amount to 36,618,023 cars, as against 36,779,474 cars in the corresponding period last year.

FISHER'S INDEX

Professor Fisher's index of wholesale commodity prices again rose fractionally last week to 144.7, as against 144.6 in the previous week and 142 four weeks earlier.

BANK DEBITS

Bank debits to individual accounts, as reported to the Federal Reserve Board for the week ended Sept. 21, were 10 per cent above the total of the preceding week and 20.7 per cent higher than the amount reported in the corresponding period of 1926.

FEDERAL RESERVE REPORT

For the same period the Federal Reserve banks reported that reserves rose $9,600,000, discounts $39,200,000, while open market purchases declined $8,100,000, U. S. Government securities $16,000,000, note circulation $7,100,000, deposits $4,800,000. Member banks for this period reported that discounts increased $45,512,000, investments $101,276,000, borrowings $45,552,000. Member bank demand deposits declined $324,742,000.

Time money and commercial paper rates were unchanged at 3¾ to 4⅜ and 3¾ to 4¼ per cent, respectively.

Paige-Detroit to Issue 300,000 Shares of Common

DETROIT, Sept. 29—Paige-Detroit Motor Car Co. directors have voted to offer 300,000 shares of additional common stock at $10 a share on a pro rata basis to present holders. The authorized common shares would be increased from 1,500,000 to 2,000,000, with 300,000 to be issued. There would be no underwriting, the Graham brothers proposing to take over any of the new stock not subscribed. The proceeds are to provide funds to meet increased business and for enlargement of facilities. Stockholders will meet Oct. 14 to vote on the stock change.

Kingston Products Formed in Kokomo

New Company Merges Kokomo Brass, Byrne-Kingston and Kokomo Electric

KOKOMO, Sept. 26—A merger is announced of the Kokomo Brass Works, Byrne, Kingston & Co., and the Kokomo Electric Co., three closely allied firms which have been engaged in automotive manufacturing for many years here. The new firm, the Kingston Products Corp., is incorporated at $1,500,000.

With the completion of the merger, three men retire who have been active in the administration of the participating concerns practically since their beginning. They are Charles T. Byrne and George Kingston, who were long associated with the late J. W. Johnson in the Kokomo Brass Works and Byrne, Kingston & Co., and John P. Grace, who was also associated with Mr. Johnson through his connection with the Kokomo Electric Co. Their interests are taken over by the families of J. W. Johnson and James F. Ryan, both of whom are deceased.

Officers of the new company are as follows: Paul Johnson, president and general manager; Frank C. Ryan, secretary and treasurer; directors: Paul Johnson, Frank C. Ryan, Carlton M. Higbie (Detroit), Fay Beal and Karl Johnson. Other stockholders are Ralph G. Kingston, John P. Grace and a number of executives of the organization.

According to a statement from the president, large savings are expected to result from the centralized control of the extensive interests and from the improved facilities for volume production. Mr. Johnson asserted that the merger in no wise implied a refinancing of the group and stated that none would be made.

The superintendents throughout the factories of the firms, together with the engineering staffs, are composed largely of veteran men who have been with the companies for many years—many of them since the organization.

Splitdorf Buys American

MILWAUKEE, Sept. 26—Controlling interest in the American Electric Motors, Inc., with plant at Cedarsburg, Wis., has been purchased by the Splitdorf Electric Co., a subsidiary of the Splitdorf-Bethlehem Electric Co. The new owner will continue the manufacture of the present line of motors on an enlarged scale and broaden the line to include units up to 30 hp.

Bus Association to Meet

ANN ARBOR, MICH., Sept. 26—A conference on highway transport and the sixth annual meeting of the Michigan Motor Bus Association will be held here Oct. 6, 7 and 8.

Seiberling Promotes Time Tire Selling

AKRON, Sept. 26—Seiberling Rubber Co. is recommending a policy of instalment sales to its dealer organization. This recommendation is made following a study of instalment selling which several of its dealers in different parts of the country had made effective. The company is assisting dealers in each state to formulate a sales plan complying with the state laws.

Reo Motor Reorganizes Canadian Distribution

WINDSOR, ONT., Sept. 26—Reo Motor Car Co., has revised its Canadian wholesale arrangements. R. G. Hudson, foreign sales manager, has succeeded D. B. McCoy as manager of Reo interests in Canada. Mr. Hudson is making his headquarters at the Lansing factory and is handling Canadian sales through three zone supervisors. A. Legault is looking after Quebec and the Maritime Provinces, and W. G. Cairns is supervising the Western provinces. W. M. Hughes, formerly in charge of the Canadian parts business at Windsor, is now associated with Reo Motor Sales Co. at Toronto. C. T. Smith, who was assistant to Mr. McCoy at Windsor, has joined the Reo-Georgia Co. at Atlanta. The Reo retail store at Windsor has been reorganized and placed in charge of W. C. Turnbull, who has for years been treasurer of the Reo Motor Car Co. of Canada, Ltd.

Warner Electric Brake Co. Names Officers and Board

CHICAGO, Sept. 24—Officers of the Warner Electric Brake Corp., formed for the manufacture and sale of the Warner electric brake, are A. P. Warner, president; C. H. Warner, vice-president; R. L. Pearce, secretary and treasurer; A. P. Warner, C. H. Warner, R. L. Pearce and Walter Inderrieden, directors. The Warner brothers are the designers of the brake, Mr. Inderrieden is an official of the Warner Patterson Co., and Mr. Pearce is acting for B. L. Rosset & Co. of Chicago.

The new corporation had planned to place $500,000 worth of stock on the market, but the majority was subscribed before its issue and the corporation now believes very little, if any, stock will be placed at the disposal of the public.

To Show Electric Trucks

NEW YORK, Sept. 26—The latest models of electric street trucks will be shown at the annual Electrical & Industrial Exposition at the Grand Central Palace, Oct. 12 to 22. Manufacturers will follow out the plan inaugurated at last year's show of exhibiting jointly.

Nash Quarter Profit Rises to $6,298,524

Total for Nine Months Increases to $15,790,259—Orders Exceed Capacity

CHICAGO, Sept. 22—Nash Motor Co. reported net income for the third quarter of its fiscal year 1927, ended Aug. 31, after deducting expenses, depreciation and taxes, was $6,298,524, as compared with $4,643,658 for the corresponding quarter of 1926. Earnings for the nine months of the fiscal year total $15,790,259 against $14,791,991 for the corresponding period of 1926.

The earnings of the company for the nine months period of 1927 have been very satisfactory. Indeed "it might not be amiss to point out," said C. W. Nash, president, "that although sales were the greatest in our history, following the introduction of our new models, we still might have done a larger volume of business had our productive capacity been greater as both July and August ended with more orders for immediate deliveries than we could fill."

Referring to the future of the company and the business outlook, Mr. Nash said: "I am prepared to believe that the facts at hand indicate that this company will continue to enjoy its full share of business as the year goes forward. Our new line has been received with exceptional favor by the public and in view of general sound commercial and industrial conditions that prevail throughout the country as a whole, and the satisfactory crops reported in most sections, I see no reason not to anticipate a continuation of normal good business."

Directors declared the regular quarterly dividend of $1 and an extra dividend of 50 cents per share payable Nov. 1.

Builds Electric Door Opener

KALAMAZOO, Sept. 26—Simplifying the job of opening and closing garage doors is the idea behind the electric door opener introduced by the American Appliance Co., this city. The mechanism is driven by a special induction repulsion motor with great starting torque. It also has a heavy overload capacity to care for emergencies. There is also a safety clutch to throw out at a slight pressure.

Flint Club Buys Property

FLINT, Sept. 26—The Industrial Mutual Association, a benefit and social organization composed of thousands of workers in Flint automobile factories, has purchased the entire plant and grounds of the Randall Lumber & Coal Co., a block from headquarters in the Industrial Bank Building. The property embraces nine acrees in the heart of the city and eventually will be utilized for an expansion of the club's facilities.

Excise Tax Repeal Second, Says Smoot

Senator Places Corporation Tax Reduction First—Doubts Early Relief

SALT LAKE CITY, Sept. 24—"Although the excise tax upon the automobile industry has been reduced 2 per cent since the war, it is still high and discriminatory, and I hope for its ultimate abolishment," declared Senator Reed Smoot of Utah in a talk this week before the Utah Automobile Dealers' Association at the Hotel Utah. The Senator thought, however, the first reduction should be in the corporation tax and the next in the excise tax, including the tax on automobiles.

He doubted whether relief might be expected soon because of the heavy appropriations the government was called upon to make for Mississippi flood relief, the Boulder Dam project, the St. Lawrence Canal and other undertakings. The speaker urged members of the automotive industry of the state to steer clear of off-color tactics, saying that they accomplished no good.

President Melvin R. Ballard of the association, who is vice-president and general manager of the Covey-Ballard Motor Co., presided at the meeting.

Reeves Says Repeal Now or Face Permanent Tax

WASHINGTON, Sept. 26—A prediction that Congress "in its wisdom" will repeal the 3 per cent excise tax still on passenger automobiles, was made here this week by Alfred Reeves, general manager of the National Automobile Chamber of Commerce.

"With everyone against the tax, it is my firm belief that Congress at the forthcoming session will abolish it," Mr. Reeves declared, pointing out that unless it is repealed at this time that it might become a permanent tax such as is levied on tobacco.

He declared that the abolition of the 10-year-old war excise tax, should have been done years ago. "The chamber, the American Automobile Association, the National Automobile Dealers' Association, parts and body builders and individual users must use their influence with their congressmen and let them know their views," Mr. Reeves said.

Opens Boston Sales Office

BOSTON, Sept. 27—The Alexander Milburn Co., Baltimore, has organized an office here to be known as the Alexander Milburn Sales Co., with headquarters at 50 Terminal St. The office will be under the direction of M. B. Crouse and G. B. Malone, both experienced executives in welding and cutting equipment. The office will provide sales facilities in the New England territory.

Denver Car Sales $42,751,200 in 1926

WASHINGTON, Sept. 27—An analysis of the 4604 establishments engaged in business in Denver, during the year 1926, shows that there were 80 concerns selling automobiles who did a gross business of $42,751,200 during the year, giving employment to 824 persons and paid $1,599,100 in salaries and wages.

The figures are contained in a census showing just how various commodities are distributed in various cities, made by the U. S. Department of Commerce. The Denver figures show that the automobile business in that city ranks third, being outclassed only by the grocery and delicatessen establishments. There were 23 automobile concerns classed as wholesalers and 57 as retailers.

Million Car Growth Seen in Ohio by '31

COLUMBUS, Sept. 27—The sum of $100,000,000 must be spent within the next five years in the reconstruction and widening of the highways of Ohio, if it is to cope with the ever-increasing requirements of traffic. This is the gist of the report of the federal road experts submitted Sept. 24 following the two-year road survey conducted in Ohio, with the aid of the Ohio Highway Commission.

The report shows that in the five-year period, from 1926 to 1931, the state should reconstruct 1220 miles of roadway, widen 1592 miles and build 1707 miles of new roadway, the estimated cost of such work being $100,000,000.

The federal road experts believe that in 1935 there will be one automobile for every 2.8 persons in the state. That would mean 2,607,000 automobiles which is a million more than there are at present. Pointing out that traffic congestion will increase in direct proportion to the increase in the number of automobiles it is up to the road officials to relieve this congestion.

Shows Grinder Installations

CINCINNATI, Sept. 26—Cincinnati Grinders, Inc., has completed four films giving views of installations of its grinders in leading plants in the United States and abroad. The films are available without charge for educational institutions, apprentice schools, foreman clubs and engineering societies. The films are not motion pictures but a series of still pictures. A special lecture giving technical discussion of the films also may be had.

Car Manufacturers Reduce Tire Orders

Akron Operations Now About 85% of Capacity—Year Shipments Higher

AKRON, Sept. 26—Following record breaking sales and production in the first eight months of the year, practically all the tire manufacturing plants have been curtailing operations during September until they are now running about 85 per cent of capacity. A let up from the rapid pace set by the industry was expected, and is regarded as nothing more than seasonal.

Retail tire sales were stimulated by the warm weather earlier in the month, but have since slowed up. Shipments to automobile manufacturers have not been nearly as heavy as they were last month.

Even with the curtailed schedules in effect, total tire output is still considerably ahead of the same period last year. Officials of Goodyear Tire & Rubber Co. have recently reported sales to be 20 per cent in excess of the previous year's volume. The Goodrich and Firestone plants have been doing equally as well or better. Net earnings of the well managed tire companies have in many cases already exceeded income for the entire year of 1926.

Minnesota Registrations Exceed $10,000,000 Mark

ST. PAUL, Sept. 26—Receipts from registration of motor vehicles in the state have for the first time passed the $10,000,000 mark, reaching $10,008,288 compared with $9,984,567 in all of 1926. Registration to date is 635,992 compared with 637,691 vehicles in 1926. The average license fee paid to July 31 was 27 cents less than in 1926, or $15.84 compared with $16.11. Factory price cuts are responsible as the fee is based on the factory price. In the case of old cars the fee is based on the 1927 price with the annual 10 per cent reduction for age.

Registration of farm produce and general delivery trucks increased this year over 1926, but was less for commercial trucks. Registration of farmer trucks increased 16.14 per cent up to Sept. 1, or to 35,070 compared with 30,175. Registration of delivery trucks was 39,002 compared with 36,522, but commercial trucks registered Sept. 1 numbered 2980 compared with 3987 in 1926.

New Jersey Shows Sales Gain

NEW YORK, Sept. 26—New car sales in New Jersey totaled 9722 units in August against 9146 in July and 8863 in August, 1926, according to Sherlock & Arnold's figures. Truck sales in August were 1234 against 1259 in the same month a year ago. The falling off is mainly in the heavy duty field.

Men of the Industry and What They Are Doing

Overland Star Salesmen See Tunney Win Fight

One hundred and fifty members of the Willys-Overland $100,000 Club were guests of the company at the Tunney-Dempsey exhibition, following a two-day visit at the factory. The club is composed of retail salesmen who have sold a minimum of $100,000 worth of Willys-Overland cars during the past year.

Business meetings at the factory were addressed by L. G. Peed, general sales manager, and R. M. Rowland, sales promotion manager. At a dinner closing the factory sessions addresses were made by John N. Willys, president; D. R. Wilson, president of Wilson Foundry & Machine Co., and Mr. Peed.

Chrysler and Fields Sail

Walter P. Chrysler, president of the Chrysler Corp., with Joseph B. Fields, vice-president, and Byron C. Foy, of Colt, Stewart & Foy, Inc., New York distributor of Chrysler cars, are sailing for Europe, Oct. 1, to attend the Paris and London shows. Mr. Chrysler will address dealer meetings in both cities and will visit the Chrysler continental headquarters at Antwerp, and the assembling plant in Berlin.

Stevens Takes New Position

E. N. Stevens has been appointed assistant sales manager of the Bastian Blessing Co., Chicago. He will work with E. L. Mills in promoting the sale of RegO Oxy-Acetylene welding and cutting equipment. Mr. Stevens was for 10 years sales manager of the Imperial Brass Mfg. Co., Chicago, and is familiar with the distribution of oxy-acetylene through jobbing channels.

Johnson Joins Durant

T. S. "Ted" Johnston has been appointed assistant to W. C. Durant and will make his headquarters at the Durant Motor Co. New Jersey plant at Elizabeth. Mr. Johnston has been closely associated with Mr. Durant since the early days of the industry and has a record as a builder of dealer organizations.

Champion Goes Abroad

Albert Champion, president of the AC Spark Plug Co., is sailing for Europe, Oct. 1 on his annual trip in the interest of the company's European factories. He will inspect the new AC factory at Paris and will visit the Paris and London shows.

Zens Visits Dealers Abroad

Paul Zens, vice-president in charge of sales of Jordan Motor Car Co., is now in Europe where he will attend the Paris and London shows. During his stay in Paris a convention of all Jordan European dealers will be held.

Henderson Honored for 47 Years' Work

A. J. Henderson, traffic manager of the White Co., was honored at the Cleveland Industrial Exposition with a medal as the second oldest, in point of service, of an employee of an Ohio company. Mr. Henderson has been with the White company for 47 years, and has not missed a day in all this time because of illness.

Marmon Promotes Sormane

Walter Sormane has been appointed European service manager of Marmon Motor Car Co. He will have charge of service work abroad and will travel extensively in England and on the continent aiding service departments of foreign dealers. Mr. Sormane previously had been identified with the Marmon company in the United States. His home is in Zurich, Switzerland, in which city he will make his headquarters.

Lincoln Names Sales Head

Sales of the Lincoln Mfg. Co., Connersville, Ind., have been placed in charge of Neil S. Lincoln, vice-president, whose headquarters will be at 3350 Lawrence Ave., Detroit. Mr. Lincoln joined the company in 1921 and has been actively engaged in its affairs since that time.

Wiley on European Trip

R. S. Wiley, export manager of the Auburn Automobile Co., is sailing for Europe Oct. 1 to attend the Paris and London shows. He will be accompanied by C. S. Johnson, European representative of the company. While abroad he will visit Auburn dealers in all leading cities.

Associates Join Young

Three former associates of F. M. Young at Racine Radiator Co., have joined the new Young Radiator Co., D. A. Hissey as production manager; W. C. Klespe as engineer in charge of machinery design, and C. R. Trumm, as head of the tool room.

Charles E. White

MOLINE, Sept. 24 — Charles E. White, for 35 years identified with the industrial life of this city, superintendent of the Deere & Mansur plant 14 years prior to his retirement from active work in 1917, and for many years consulting expert in labor and personnel problems for Deere & Co., died Sept. 16 in his home here.

Mueller Sales Meeting Held at Company's Club

Mueller Brass Co. of Port Huron has just completed its fifth annual salesmen's meeting, with 25 representatives from all parts of the country returned to their territories. Four daily sessions were held at the Mueller Golf and Country Club, a subsidiary, where the representatives were examined as to their knowledge of the company's products.

A five-year service pin was awarded to William M. Orr of Pittsburgh in recognition of five years' service. Prizes for obtaining difficult accounts were awarded to L. A. Mitchell, W. C. Young, C. A. Nenno, Hal Kleimann, George Reamer and H. L. Hess.

Frank on European Trip

Arvid L. Frank, assistant manager of export sales for the Studebaker Corp. of America, will sail from New York for Europe Sept. 28. On his arrival, Mr. Frank will attend the International Automobile Show in Paris, Following this, Mr. Frank will visit French distributors, and then attend the London Olympia on Oct. 13. At the close of the British show, he will return to the continent to visit Studebaker-Erskine distributors in Belgium and Germany, and make an intensive study of market conditions in these countries.

Stone Branch Manager

Charles O. Stone, wholesale manager of Anger, Inc., Milwaukee, has been promoted to manager of the Milwaukee factory branch of Willys-Overland, Inc. He succeeds Bert F. Anger, president of Anger, Inc., who accepted the branch managership temporarily upon the death of Tom C. McMillan.

Dornseif Western Manager

A. J. Dornseif, who has been division manager in St. Louis for the past six years for the Murray Rubber Co., Trenton, N. J., has been promoted to division manager for the western district. He will have headquarters both in St. Louis and in Chicago.

Steves Becomes Dealer

C. M. Steves, former director of sales for Chevrolet on the Pacific coast, and afterward in charge of sales in the same territory for Locomobile and Flint, has become head of the Broad Motor Co., newly-appointed Star dealer in San Francisco.

German Parts Buyer Sails

C. L. de Muralt, of Muralt & Co., Munich, Germany, who has been in the United States for four weeks placing large orders for parts to be used in cars in Germany, will sail for home next week.

Reeves Gives Views on European Market

Says Luxury Belief Greatest Problem—Each Country Needs Separate Study

NEW YORK, Sept. 28—Pointing out that the greatest drawback to automobile sales in European countries is the belief that motor cars belong in the luxury class, Alfred Reeves, general manager of the National Automobile Chamber of Commerce, who recently returned from abroad with several other officers of the chamber, has just presented some observations and recommendations having to do with the foreign trade in motor cars.

It is important, said Mr. Reeves, that export managers treat each country as a separate problem rather than attempt to have one plan cover all of Europe. Some countries fare better when parts are sent by parcel post; others by freight or express. He says:

"To aid in broadening markets in the countries we visited, our manufacturers of cars, trucks, tires and accessories must consider and be ready to aid in connection with the following:

1. Get motor cars out of the luxury class.
2. Teach women to drive.
3. Lower taxes, particularly on the first sale of the car; sales taxes in Denmark run as high as 40 per cent on the amounts above $2,370.
4. More improved highways with funds from motor vehicle registration for use only on the roads. The English system is in excellent shape.
5. Important for American makers to have the highest possible type of foreign representatives and especially men who are sympathetic with the countries visited. Dealers complain of the many changes in representatives of American factories, and it takes time for new men to learn the problems of the dealers and the country.
6. Need for more funds at reasonable rates to be used for instalment selling.
7. Discourage dealers from overloading the American list price, thus curtailing markets.
8. Careful study by competent representatives of the requirements of each country. For example: There is a run on small sixes in some countries just now, while others demand four-cylinder jobs. Colors are most important. Dealers ask that with every special paint job there should be included a pint of the paint used.
9. Supply all possible kinds of sales help but of a character especially prepared for the country.
10. A large amount of Europe's business is done on credit and dealers do not wish to pay for cars until received. They ask some provision for financing stocks and retail purchases."

Lowe Succeeds Plimpton

NEW YORK, Sept. 26—R. E. Plimpton has resigned as chairman of the Metropolitan Section of the Society of Automotive Engineers, as his business calls him to Chicago. E. F. Lowe succeeds him as chairman of the section.

Schneider Winner Speeds 281 M.P.H.

NEW YORK, Sept. 27—Two planes representing Great Britain finished first and second in the Schneider Cup races held at Venice, Italy, yesterday, according to advices received here. All three Italian planes and one of the British entries were forced out by engine trouble. Lieut. S. N. Webster, in a Super-Marine monoplane with a Napier engine, completed the 217-mile course at an average speed of more than 281 m.p.h. Lieut. S. M. Kinkead, in a Gloster Napier biplane, traveled one lap at the rate of 289.75 m.p.h., the highest officially recorded speed ever reached by a human being.

British Plantations Show Profits Drop

WASHINGTON, Sept. 28—A net reduction of 13½ per cent in profits is reported by 40 miscellaneous British manufacturing and plantation companies, during the fiscal year ending June 30, 1927, compared with the previous fiscal year. Included in the list are five automobile manufacturers and seven rubber concerns. The automobile manufacturers are not named, but the figures show smaller profits for the rubber planters.

The Banting Rubber Co. showed a profit of 25 per cent in 1927, compared with 45 per cent in 1926; Caledonian Rubber, 13½ compared with 45; Chembond Rubber, 10 compared with 16; Port Dickson Rubber, 17½ compared with 27½; Pyre Rubber, 10 compared with 15; Sarawak, 40, compared with 60, and Semenyik, 30 compared with 35.

Dunlop Companies Merge

WASHINGTON, Sept. 27—The long proposed merger of the Dunlop Rubber Co. of Australia, with the Dunlop Rubber Co. of England, has been consummated, H. R. Buckley, U. S. Trade Commissioner at Sydney, reports to the Department of Commerce.

Velie Motors Introduces 6-Cylinder Speed Truck

MOLINE, Sept. 28—Velie Motors Corp. has introduced a model 40, 1½-ton speed truck of 134 in. wheelbase and powered by its six-cylinder, valve-in-head engine. Features include full forced feed lubrication, a 92 lb. crankshaft having 21¾ sq. in. of bearing surface, oil filter and gasoline purifier, 7 in. pressed steel frame members, Stromberg shock absorbers, Lockheed hydraulic four-wheel brakes with 16-in. drums, and Ross steering gear.

National Air Racers Set Class Records

Winner in Military Observation Class Has Wing Radiators—290 lb. Plane Flown

SPOKANE, Sept. 26—Attaining a speed of 170.156 m.p.h., Lieut. H. A. Johnson, Army, made the greatest speed ever attained by a military observation plane in this country if not in the world. His plane was one of two ordered fitted by the Army with Curtiss V-1550 water-cooled engines and wing radiators, especially for the National Air Races.

The free for all 12-lap, 120-mile race was won by Lieut. E. C. Batten, Army, in a Curtiss X. P. 6-A, at a speed of 201.239 m.p.h. The engine on this ship was a 700 hp. job built especially for speed.

In the 60-mile large capacity race, the tri-motor Fokker monoplane piloted by Lieut. Kenneth Beaton, made 115.198 m.p.h., defeating two Douglas Transports.

The Heath "Baby Parasol" flown by R. B. Heath of Chicago, won the 30-mile race uncontested at 74.443 m.p.h. The plane weighed 290 lb. He also won uncontested the 60-mile at 73.417 miles.

Lieut. Thomas P. Jeter, Navy, in Boening FB 5, won the Navy pursuit type 120-mile race on the 10-mile course at an average speed of 177.140 m.p.h. His plane was powered with a Pratt & Whitney 550 hp. engine. He led on every lap crossing the line after diving start at 177.971 m.p.h., the greatest speed made on the first day of the two-day National Air Races. A similar plane piloted by Lieut. H. E. Eagan, Navy, was second, at a speed of 171.641.

In the Army pursuit type race of 60 miles, Lieut. W. L. Cornelius in a Curtiss Hawk was first at a speed of 158.412 miles.

Financial Notes

Midland Steel Products Co. Cleveland, earnings for August were $211,695, after all charges, except Federal taxes and profit sharing, according to announcement by E. J. Kulas, president. The August figure represented an increase over the earnings for July, before Federal taxes and profit sharing, of $206,209.

Detroit Trust Co., as trustee, has invited tenders of bonds of Murray Body Corp., now the Murray Corp. of America, before Oct. 14, 1927. The trust company has on hand funds to retire $80,000, par value of the funds.

India Tire & Rubber Co. has reduced its bank obligations by $250,000 since Jan. 1, P. C. Searles, secretary and treasuer, has announced. The ratio of current assets to liabilities is improved and inventories are being reduced steadily.

Steel Activity Waits Automotive Demand

Improved Demand Noted for Some Descriptions But General Market Slow

NEW YORK, Sept. 30—The steel market has its eyes more on Detroit than on Pittsburgh. Opinion is almost unanimous that a revival of automotive demand must precede a betterment of conditions in the steel industry. Rolling mills are eagerly awaiting resumption of shipping instructions from the Chevrolet Motor Co.

Recent announcement by the Carnegie Steel Co. of a 1.75 cent, base Pittsburgh, price for large tonnages of bars, plates and shapes and 1.85 cents for small lots was prompted chiefly by conditions in the structural steel market, but its effect on the cold-finished steel bar market has been of direct automotive interest, resulting in a uniform price of 2.20 cents, base Pittsburgh, which until now only the largest consumers had enjoyed.

Judging from the somewhat improved demand for sheet bars, some sheet mills must have been able to accumulate a small backlog of orders. While some descriptions of sheets are rather irregular in price, that for full-finished automobile sheets appears to be well maintained. The recent change in tonnage differentials on cold-rolled strip steel, by which buyers of 3-ton lots are based on an even footing with those buying 18 tons at one time, has released a number of small orders, but on the whole demand for both cold and hot-rolled strip steel is far from satisfactory to mills.

Quite a little fourth quarter business from manufacturers of medium and higher-priced passenger motor cars is likely to be placed within the next few days, negotiations, especially with alloy steel producers, having been on since the middle of the month. Alloy steel prices are fairly well held, producers claiming that further reductions are utterly precluded by costs.

Some automotive consumers have placed fourth quarter business for bolts and nuts, tonnages involved being, however, very light. There is every indication that competition for what fourth quarter business remains to be placed will be keen.

Pig Iron—Automotive foundries are buying on a carload basis, when they do buy, but most melters are not taking on any fresh supplies and are postponing shipping instructions on old contracts. The Valley market for No. 2 foundry and malleable continues nominally on a $17.50 basis. No change is noted in the Michigan price situation.

Aluminum—The market continues in abundant supply, but this has no effect on prices which remain pegged at old levels. Many automotive consumers have been buying in hand-to-mouth fashion throughout the year, and importers are of the opinion that, in spite of the general slowing down in the automotive industries, considerable demand still overhangs the market. Secondary metal is unchanged in price, with the market's tone easy.

Copper—The market has turned rather dull, but producers are not disposed to shade prices in order to quicken sales. In the Middle West, both lake and electrolytic were available in the forepart of the week at 13¼ cents, delivered, without consumers showing any interest.

Tin—Although prices at the opening of the week offered opportunity to consumers to shade 60 cents, which they had not been able to do in a long time, very little interest was shown, the market being utterly stagnant.

Lead—More interest is shown by battery manufacturers, but, chiefly under the influence of unfavorable London cables, the market continues to make for timidity on the part of consumers.

Zinc—The market is quiet but fairly steady.

Lupton Recapitalization Voted by Stockholders

PHILADELPHIA, Sept. 26—Stockholders of David Lupton's Sons Co. have approved recapitalization plans under which $5,000,000 in 6 per cent first mortgage gold bonds, $5,000,000 in 7 per cent cumulative preferred stock and 300,000 shares of common stock without par value are authorized. Of these $2,000,000 of the bonds, $1,000,000 of the preferred stock, and 100,000 shares of the common stock are to be outstanding.

The proceeds of the financing will be used to retire current obligations, which include the cost to date of extensive plant additions and improvements, to provide funds for the balance of improvements and for additional working capital.

The present management of the company will continue unchanged but the engineering firm of Ford, Bacon & Davis, Inc., will be associated in an advisory capacity. The engineering company has acquired a substantial interest in the common stock. The board of directors has been increased to 15; the new members being G. K. Reilly, S. M. Fox, L. L. Odell and Walter Lupton.

Iowa Plane Company Plans $1,000 Craft

BURLINGTON, IA., Sept. 24—The Romkey Airplane Corp., a Delaware organization with $150,000 capital stock, has been formed and will start an airplane factory here within 60 days, if satisfactory factory and landing field concessions can be obtained from local industrial interests. Lyman E. Cook is president of the company, which will make a plane designed to sell for $2,600. Inside of six months the company expects to employ 50 men and have a production schedule of from eight to 12 planes monthly. Engines will be Curtiss OS-6 100-hp. The company's engineer expects to complete plans soon for a plane which will be sold as low as $1,000.

A.E.A. Sets Program for Coming Meeting

Dinner for Small Tool Makers Feature—Overseas Dinner Set for Third Day

CHICAGO, Sept. 24—The tentative program for the thirteenth annual convention and ninth annual exhibit of the Automotive Equipment Association to be held Nov. 7 to 12 here, was released today by J. E. Duffield, asistant commissioner of the association.

The opening day will be featured by the annual election and a dinner in the evening for small tool manufacturers. The second day will include the second general session at which the Greater Market Development of the A. E. A. will be presented. Wednesday manufacturers and jobber divisions will hold separate sessions, the former at the Coliseum and the latter at the Stevens Hotel. That evening the Overseas annual banquet will be held at the Stevens.

The detailed program follows:

Nov. 4, 5 and 6, 9 A.M.—Registration Stevens Hotel
Nov. 4, 10 A.M.—Membership Committee .....Stevens Hotel
Nov. 4 and 5, 10 A.M.—Board of Directors .....Stevens Hotel
Nov. 6, 7 P.M.—Annual Boosters' Banquet .....Stevens Hotel

Monday, Nov. 7

10 A.M. .....First General Session
1 P.M. .....Annual Election
2.30 P.M. .....State Vice-Presidents
6.30 P.M.—Small Tool Mfrs. Stevens Hotel

Tuesday, Nov. 8

10 A.M.—Second General Session Greater Market Development
2.30 P.M.....Jobbers' Regional Meetings
7 P.M. to 10.30 P.M. Open to Retail Dealers by Invitation

Wednesday, Nov. 9

10 A.M.—Manufacturers' Division—Coliseum Jobbers' Division—Stevens Hotel
7 P.M. to 10.30 P.M. Open to Retail Dealers by Invitation
7 P.M. .....Overseas Annual Banquet Stevens Hotel

Thursday, Nov. 10

10 A.M. .....Third General Session
2 P.M. ....Jobbers Sales Managers' Forum
7 P.M.....Annual Banquet—Ball Room Stevens Hotel

Friday, Nov. 11

No General Sessions

Saturday, Nov. 12

9 A.M. .....Fourth General Session

Gets Patent on Axle Gage

ROCK ISLAND, ILL., Sept. 26—With the granting of a patent on the Bear axle gage, the exclusive right to manufacture and sell these gages has been assigned by the inventor, Henry Wochner, to the Bear Mfg. Co., this city. The gage is described as a device to correct inaccuracies in the positioning of the front axle of a vehicle. The patent is No. 1,641,243, and since application was filed nearly two years ago, the device has come into large use in automobile factories and in service establishments.

Medium Sized Tank Developed by Army

Colonel Wall Describes Ordnance Developments to Pennsylvania S.A.E. Section

PHILADELPHIA, Sept. 26—A new medium sized tank weighing about 23 tons and having a top speed of 10 m. p. h. has been developed by the U. S. Army and bids fair to displace both the larger and smaller types previously used, Col. William Guy Wall, president-elect of the Society of Automotive Engineers, told the Pennsylvania section of the society when he addressed its opening fall session Friday.

Colonel Wall, who also is chairman of the Army Ordnance Association, outlined numerous recent advances in ordnance equipment, pointing out among other things that anti-aircraft guns, while relatively ineffective during the war, have now been brought to a stage of development where they constitute effective defensive weapons.

In further development of track design for crawler tracks on tanks, he said, lies one of the greatest opportunities for design improvement in the ordnance field.

Tests made at the Aberdeen proving ground in regard to heavy transmissions, he stated, have resulted in the following conclusions:

"That the efficiency of a heavy transmission increases rapidly with load but varies little with load, after reaching the range which includes the load for which it was designed.

"The efficiency of a heavy transmission varies with the gear ratio, increasing with the ratio, that is, the higher the speeds, the less the efficiency.

"That the figure 0.97 may safely be used in designs and estimates as the efficiency per contact, including bearings at full load, for heavy spur gears of high grade heat-treated steel, carefully machined and aligned, running on anti-friction bearings well lubricated with oil."

The meeting, which began with a golf party in the afternoon and continued with varied entertainment and get-together features in the evening, was attended by over 50 members and guests.

200 Attend S. A. E. Frolic

NEW YORK, Sept. 24—The annual frolic of the Metropolitan Section of the Society of Automotive Engineers this week attracted more than 200 members and their guests to the Manhasset Bay Yacht Club, Port Washington, L. I. The trip was made in 10 buses from New York.

U. S. to Get Pike's Peak Road

WASHINGTON, Sept. 29—Public ownership of the highway to the summit of Pike's Peak is guaranteed by the action of Secretary of Agriculture Jardine in accepting the offer of the Pike's Peak Auto Highway Co. to convey to the United States its present highway to the summit of the mountain, together with 500 acres of land. The company reserves the right to collect tolls at the prevailing rate until the close of 1935. Secretary Jardine rejected the offer of W. D. Corley to construct a second toll road to the summit on the opposite side of the mountain, to become public property within six years.

Standards Bureau Reports on Piston Friction Test

WASHINGTON, Sept. 27—The proportion of friction in an internal combustion engine caused by the friction of pistons and rings, has been made the basis of a study by the U. S. Bureau of Standards. Its report is made public by the National Advisory Committee for Aeronautics, known as Technical Report No. 262, under the title "Friction of Aviation Engines." Copies of the report may be had on application to the committee.

A portion of the report deals with measurements of the friction of a group of pistons used in a truck engine and differing from each other in a single respect such as length, clearance, area of thrust face, location of thrust face, etc. The report summarizes the results of the friction measurements.

Will Sell Brasco Line

CHICAGO, Sept. 26—Brasco Mfg. Co. has appointed Middleton, Eden & Co., Cleveland, to handle sales of its automotive division, which makes a complete line of drawn and rolled steel, brass and white metal shapes for automotive body use.

Kansas City Wrecks 125 Cars Monthly

Dealers' Yard Aims to Triple Operations—Junk Men Stiffen Competition

KANSAS CITY, Sept. 26—The United Automobile Wrecking Co., Inc., owned by members of the Kansas City Motor Car Dealers Association, now is wrecking approximately 125 cars a month. The plan is to increase this gradually until 300 to 450 cars are wrecked each month. Since the business was started in June, the company has purchased approximately 500 cars from motor car dealers, every one of which is wrecked or will be. The company's sales of used parts is increasing rapidly but no junk metal has yet been sold.

The company has run into some difficulties common to new organizations. Junk dealers, who formerly paid the dealers from $7.50 to $17.50 for junk cars—and then turned around and sold 40 per cent of them to used car prospects—now are outbidding the dealer owned wrecking company, offering as high as $50 for junk cars, and a few dealers are "breaking faith" and selling to the junk men. The average price paid by the United company so far is $21.

Tom Shugrue, manager of the company, now is preparing a parts catalog which will be distributed over a wide area. When this is done it is expected that dealers and garagemen will find it much easier to order parts.

Baltimore Public Schools to Establish Course for Training Automobile Mechanics

BALTIMORE, Sept. 29—A school for the training of automobile mechanics, which will be operated by the public school system of Baltimore in conjunction with a committee representing the trade, is to be opened in Baltimore in October. The institution will be conducted along entirely different lines than any other school operated for the same purpose, it is said.

Four years ago the school authorities established a printing school in Baltimore, the employing printers furnishing the equipment and being represented by an advisory committee working in conjunction. The automobile school will be conducted along the same line and is expected to be just as successful as the printing school.

Charles W. Sylvester, director of vocational education in the schools, is in charge of the plans for establishing the school. It will open in the building at Front and Lombard streets, but will be moved to the present City College building next year when a new City College is constructed.

The members of the Baltimore Automobile Trade Association, Inc., are much interested in the school and have promised to aid in every way. Many of them have announced that they will enroll their mechanics in the night classes. Enrollment for the day classes is filled, it has been announced.

The advisory committee will have a large part in equipping the school as a model service shop. Cars and chassis for use in the school will be furnished by the dealers. They also have agreed to use the graduates of the institution where possible.

It is pointed out that the training which will be given will not only enable the dealers to get well-trained mechanics but also will provide the mechanics themselves with training which will place them in the position to earn more money.

The dealers are anxiously awaiting the opening of the school and the authorities have been given every assurance that the trade men in Baltimore will give every aid to make it a success.

Automotive Business Progressing in Spain

NEW YORK, Sept. 24—Automotive business is progressing steadily in Spain, and American products are in principal demand, according to Charles H. Cunningham, American commercial attache at Madrid, who made the principal speech at the first fall meeting of the Overseas Automotive Club, Inc., this week at the Hotel Astor.

Highway building, said Mr. Cunningham, is perhaps the main stimulus for this increasing business, as roads are being constructed in all parts of the country in a well ordered manner. He said there were 900 motor bus lines in active service in Spain. He touched upon the tariff situation and predicted an even better business for American manufacturers.

George F. Bauer, secretary of the foreign trade committee of the National Automobile Chamber of Commerce, and Kendrick Van Pelt, sales representative for a number of American automotive lines in Sao Paulo, Brazil, also talked. About 50 members and guests attended the meeting which was presided over by P. A. Karl, vice-president of the Club, who is also export manager of the Brunner Mfg. Co.

Makes Keyless Lock

DETROIT, Sept. 26—The Williams Keyless Lock Co., has introduced the Williams keyless lock and chain. The chain is welded and is of the same special steel alloy as the lock shackle designed to resist cutting by thieves. The locking mechanism is operated by a simple combination and the product is Parker rust-proofed.

Coming Feature Issues of Chilton Class Journal Publications

Nov. 10—Marketing Annual—Motor World Wholesale.

Feb. 18—Statistical Issue—Automotive Industries.

Utility Bodies to Study Interstate Regulations

WASHINGTON, Sept. 27—The question of interstate motor transport regulation will be one of the main subjects for discussion at the forthcoming session of the thirty-ninth annual convention of the National Association of Railroad and Utilities Commissioners, meeting in Dallas, Texas, Oct. 18 to 21.

The association's program was announced here this week. One whole session will be devoted to the motor vehicle question. The association is composed of members of the Interstate Commerce Commission and of the state regulatory bodies.

A. A. A. to Ask Regulation

WASHINGTON, Sept. 26—Interstate regulation of motor buses and repeal of the excise tax on new bus equipment will be urged before Congress at the next session by the motor bus division of the American Automobile Association, it was announced this week. The board of directors and the legislative committee of the motor bus division will hold a series of meetings in Cleveland beginning Oct. 4, at the Winton Hotel.

Germany to Present Materials Conference

BERLIN, Sept. 20 (*by mail*)—Preparations for the conference on Engineering materials which is to take place here Oct. 22 to Nov. 13, are far advanced. The program lists about 200 papers to be read by scientists and practical engineers. Foreign scientists will be the speakers especially at the sessions on Oct. 31. While these papers, which are read at the Technical University of Charlottenburg, are intended chiefly for engineers, an exhibition of engineering materials arranged in the New Exhibition Hall on the Kaiserdamm, Berlin, will be an attraction for the general public also.

Three groups of engineering materials will be dealt with, iron and steel, non-ferrous metals and electric insulating materials.

More than 200 testing machines will be shown in operation and will introduce the visitors to the latest methods of testing, which are not familiar even to many engineers. Inquiries on the part of foreign diplomats accredited in Berlin prove that continental and overseas engineers are highly interested in this new congress.

Detailed particulars can be obtained from the "Geschaftsstelle der Werkstofftagung," Berlin NW7, Ingenieurhaus, Germany.

Show Drawing October 6

NEW YORK, Sept. 26—The annual drawing for show space by members of the National Automobile Chamber of Commerce is scheduled for Oct. 6. On the preceding day, the directors will hold a meeting.

Calendar of Coming Events

SHOWS

All Western Road Show, Los Angeles ..... March 7-11
American Electric Railway Association, Public Auditorium, Cleveland..Oct. 1-7
American Road Builders Association, Public Auditorium, Cleveland..Jan. 9-13
Argentine .....Nov. 10-20
Automotive Accessories Association, Armory, Chicago .....Nov. 7-12
Automotive Equipment Association, Coliseum, Chicago .....Nov. 7-12
*Chicago, National Automobile Chamber of Commerce, Coliseum ..... Jan. 28-Feb. 4
Electrical and Industrial Show, Grand Central Palace, New York....Oct. 12-22
Glasgow .....Nov. 4-12
International Aircraft Show, Berlin ..... March 23-April 11
Lille, France, Exposition..Nov. 20-Dec. 4
London Passenger Car Show ....Oct. 14-22
London Truck Show .....Nov. 17-26
Montevidio .....Nov. 19-27
National Standard Parts Association, Convention Hall, Cleveland..Nov. 14-18
*New York, National Automobile Chamber of Commerce, Grand Central Palace .....Jan. 7-14
Paris, Grand Palais .....Oct. 6-16
Rio de Janeiro .....May 3-13
Salon, Automobile Salon, Inc., Hotel Drake, Chicago .....Jan. 28-Feb. 4
Salon, Automobile Salon, Inc., Hotel Biltmore, Los Angeles .....Feb. 11-18
Salon, Automobile Salon, Inc., Hotel Commodore, New York..Nov. 27-Dec. 3
Salon, Automobile Salon, Inc., Palace Hotel, San Francisco..Feb. 25-March 3
United States Good Roads Show, Des Moines .....May 28-June 1

*** Will have special shop equipment exhibit.**

CONVENTIONS

American Electric Railway Association, Public Auditorium, Cleveland..Oct. 3-7
American Gear Manufacturers Association, Mt. Royal Hotel, Montreal ..... Oct. 20-22
American Road Builders' Assn., Hotel Hollenden, Cleveland .....Jan. 9-13
American Road Builders' Association, Banquet, Hollenden Hotel, Cleveland .....Jan. 11
American Society of Mechanical Engineers, First National Fuels Meeting, St. Louis .....Oct. 10-13
Associated Manufacturers of Fabric Auto Equipment, La Salle Hotel, Chicago .....Nov. 5
Automotive Equipment Association, Coliseum, Chicago .....Nov. 7-12
National Association of Finance Companies, Congress Hotel, Chicago ..... Nov. 14-15
National Foreign Trade Council, Houston, Texas .....April 25-27
National Hardware Association, Marlborough-Blenheim, Atlantic City ..... Oct. 17-20
National Research Council, Washington, D. C. .....Dec. 1-2
National Standard Parts Association, Hotel Hollenden, Cleveland..Nov. 14-18
National Tire Dealers' Association, Brown Hotel, Louisville, Ky..Nov. 15-17
Overseas Automotive Club, Inc., Monthly Luncheon, Hotel Astor, New York .....Oct. 13
Overseas Automotive Club, Inc., Overseas Visitors' Dinner, Stevens Hotel, Chicago .....Nov. 9
Overseas Automotive Club, Inc., Monthly Luncheon, Hotel Astor, New York .....Dec. 8
United States Good Roads Association and Bankhead National Highway Association, Des Moines..May 28-June 1
World Motor Transport Congress, London .....Nov. 14-17

N. A. D. A.

Chicago, Jan. 31-Feb. 2—Annual, Palmer House.
Chicago, Feb. 1—Banquet, Palmer House.
New York, Jan. 9-10—Eastern District, Hotel Commodore.

S. A. E.

National

Aberdeen Proving Ground, Oct. 6—Joint meeting with Army Ordnance Association.
Chicago, October 25-27—National Transportation and Service Meeting.
Chicago, Dec. 1—Tractor Meeting.
Detroit, Jan. 24-27—Annual Meeting.
European trip—Nov. 2-Dec. 12.
New York Sessions, October 18-20—Aeronautic Meeting.
New York, Jan. 12—Annual Dinner.

Sectional

Milwaukee, Oct. 5—First Meeting.